

170140

**APPENDIX A**

**QUALITY ASSURANCE PROJECT PLAN FOR  
VERIFICATION MONITORING PLAN**

**QUALITY ASSURANCE PROJECT PLAN  
FOR  
VERIFICATION MONITORING PLAN  
NORTHSIDE SANITARY LANDFILL  
ZIONSVILLE, INDIANA**

**Prepared for**

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**May 1994**

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**LIST OF ACRONYMS/ABBREVIATIONS**

ASTM	American Standards for Testing Materials
BNA	Base-Neutral and Acid Extractable Organic Compound (Semivolatile Organics)
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act (Superfund)
CLP	Contract Laboratory Program
CompQAP	Comprehensive Quality Assurance Plan
CRDL	Contract Required Detection Limits
CRQL	Contract Required Quantitation Limits
DQO	Data Quality Objective
IDEM	Indiana Department of Environmental Management
ISBH	Indiana State Board of Health
MS/MSD	Matrix Spike/Matrix Spike Duplicate
NPL	National Priorities List
PRP	Potentially Responsible Parties
PARCC	Precision, Accuracy, Representativeness, Completeness, and Comparability
QA	Quality Assurance
QAO	Quality Assurance Officer
QAPjP	Quality Assurance Project Plan
QC	Quality Control
RD/RA	Remedial Design/Remedial Action
RI/FS	Remedial Investigation/Feasibility Study
RPM	Remedial Project Manager
SARA	Superfund Amendments and Reauthorization Act
SOP	Standard Operating Procedure
SOW	Statement of Work
SW-846	Test Methods for Evaluating Solid Waste 1986.
TAL	Target Analyze List
TCL	Target Compound List
USEPA	United States Environmental Protection Agency
VOC	Volatile Organic Compound
VMP	Verification Monitoring Plan

## **INTRODUCTION**

The United States Environmental Protection Agency (USEPA) requires that all environmental monitoring and measurement efforts mandated or supported by USEPA participate in a centrally managed quality assurance (QA) program. Any party generating data under this program has the responsibility to implement minimum procedures to assure that the precision, accuracy, completeness, and representativeness of its data are known and documented. To ensure the responsibility is met uniformly, each party must prepare a written QA Project Plan (QAPjP) covering each project it is to perform.

This QAPjP presents the organization, objectives, functional activities and specific quality assurance (QA) and quality control (QC) activities specified in the "Verification Monitoring Plan", Geraghty & Miller, Inc., May 1994, as part of the Remedial Design and Remedial Action (RD/RA) activities at the Northside Sanitary Landfill (NSL) site, Zionsville, Indiana. This QAPjP also describes the specific protocols which will be followed for sampling, sample handling and storage, chain of custody, as well as laboratory and field analysis.

QA/QC procedures will be in accordance with applicable professional technical standards, USEPA requirements, government regulations and guidelines, and specific project goals and requirements. This QAPjP is prepared by Geraghty & Miller, Inc. in accordance with USEPA guidance documents, "Interim Guidelines and Specifications for Preparing Quality Assurance Project Plans" (QAMS-005/80), and the "Region V Model QAPjP", (1991).

As the Verification Monitoring Plan (VMP) and this Associated QAPjP will be implemented only after the RA On-Site Construction Activities are completed (anticipated to be by December 1995), specific details regarding the laboratory to be utilized (a bio process will be used for selection) and personnel assigned tasks are not included. It is



understood that before the VMP is implemented, these details will be defined and submitted to the USEPA for approval.

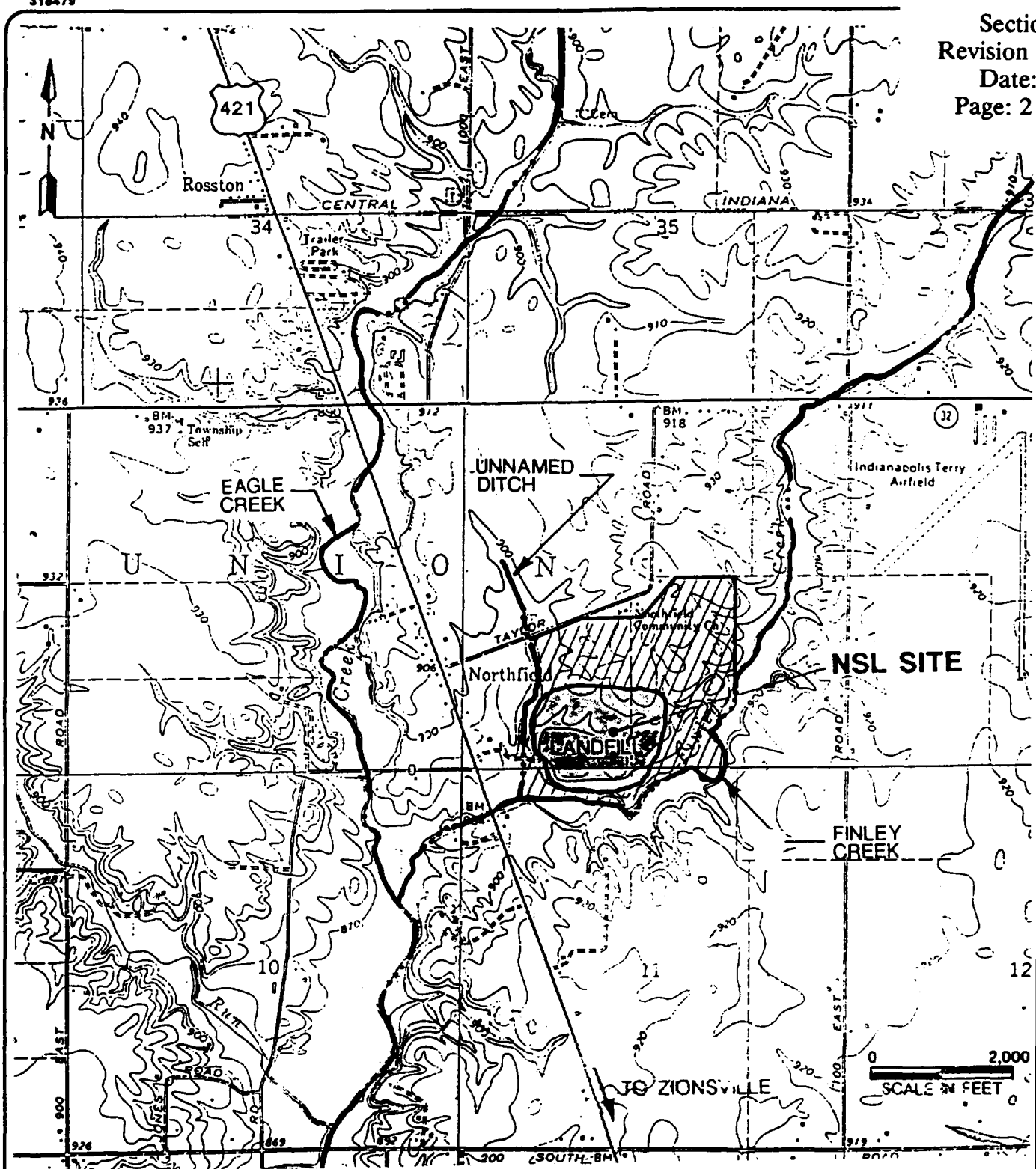
## **1.0 PROJECT DESCRIPTION**

### **1.1 SITE HISTORY/BACKGROUND INFORMATION**

The Northside Sanitary Landfill (NSL) is a privately owned and inactive solid waste disposal site located in Boone County, Indiana about 8 miles northwest of Indianapolis. The site was placed on the National Priorities List for remediation under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA or Superfund) during 1983. The location of the NSL is shown in Figure 1-1.

The Remedial Investigation and Feasibility Study (RI/FS) were completed by the USEPA and its subcontractors in 1986. The recommended remedial action program resulting from the RI/FS incorporated a combined remedy with a second superfund site which is immediately adjacent to the NSL site. Re-evaluation of the proposed remedy produced development of separate remedial action plans for the two adjacent superfund sites. The Statement of Work (SOW) (finalized in 1991, and approved by USEPA), presents the technical approach taken to remediate the NSL site. The consent decree which became effective on November 19, 1991 officially initiated Remedial Design/Remedial Action (RD/RA) activities at the site. Actual landfilling activities at the site ceased on December 31, 1991.

NSL has been the subject of environmental investigations conducted by both private parties and by government agencies from the early 1970s to the mid 1980s. The previous investigations conducted at the NSL indicated the presence of various chemical constituents in the ground water, landfill leachate, and subsurface soils at the landfill. The approved SOW presented a list of target constituents (with remediation standards) for the NSL site developed from available investigation data.



APPROXIMATE NSL PROPERTY BOUNDARY

SOURCE: ROSSTON QUADRANGLE; INDIANA-BOONE CO. (1969),  
USGS 7.5 MINUTE SERIES(TOPOGRAPHIC)

SCALE  
1"=2000'



**GERAGHTY  
& MILLER, INC.**  
Environmental Services

**SITE VICINITY MAP**  
QUALITY ASSURANCE PROJECT PLAN  
VERIFICATION MONITORING PLAN  
NORTHSIDE SANITARY LANDFILL  
ZIONSVILLE, INDIANA

FIGURE

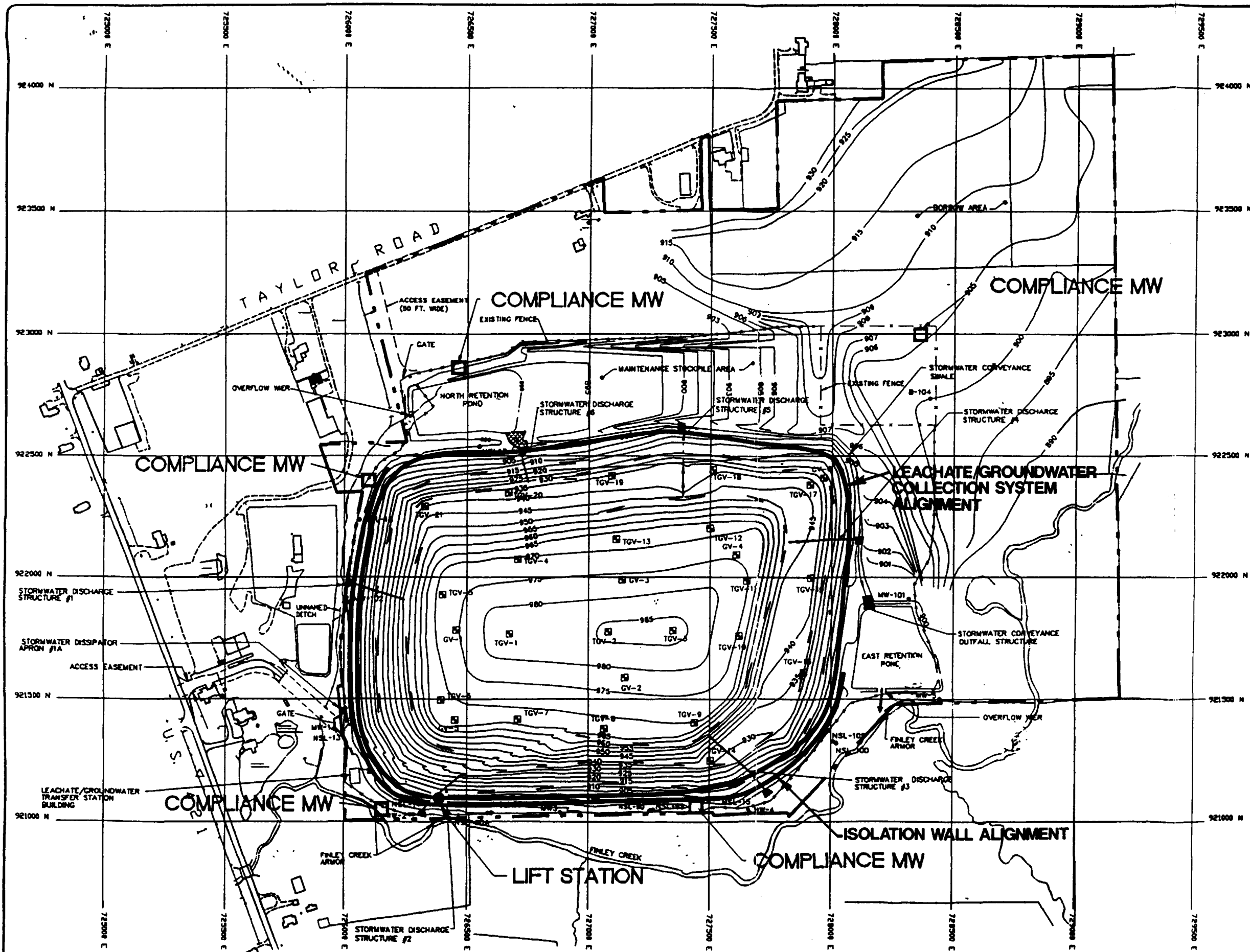
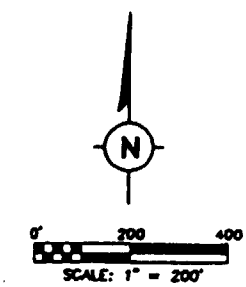
1-1

Design modifications during the RD process have resulted in very selective analytical monitoring needs included within the Verification Monitoring Plan (VMP). The VMP addresses the water-quality and air-quality monitoring activities to be performed during post-installation operation and maintenance after completion of the initial Remedial Action construction and acceptance. These activities, in conjunction with the activities described in the Operation and Maintenance Plan (Appendix F of the VMP), are designed to protect the integrity of the completed closure, monitor the performance of the individual components of the remedy, and provide the basis for final acceptance of the complete remedy and termination of site activities.

This QAPjP addresses the water-quality and analytical methodologies to be followed throughout the monitoring program of two areas; (1) monitoring the water-quality of the collected leachate/groundwater at the transfer station, and (2) monitoring upgradient and downgradient groundwater quality from specified monitoring wells. This QAPjP also addresses air-quality and analytical methodologies for monitoring the GAS Venting System. As presented in the Statement of Work (SOW), remediation standards have been established and are included in the RD/RA Consent Decree for the Northside Sanitary Landfill (NSL). These concentrations represent the analytical values which must be achieved in order to cease pumping of leachate and ground water at NSL.

## **1.2 PROJECT OBJECTIVES AND SCOPE**

The tasks described in this section have been designed to fulfill the VMP developed for the NSL site. The monitoring plan includes the periodic sampling and analysis of liquids collected in the leachate/groundwater recovery system and five perimeter monitoring wells and associated reporting. The Plan also outlines the monitoring of landfill gas being discharged from the gas venting system. A site map illustrating the monitoring and sampling locations for the leachate/groundwater and landfill gas vents is provided as Figure 1-2.



**LEGEND**

- TGV-14  
TRENCH GAS VENT  
AND DESIGNATION
- GV-1  
VERTICAL GAS VENT  
AND DESIGNATION



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REV.	NO.	DATE	DESCRIPTION	BY	APPR.

PROJECT NO.	PROJECT NAME	FILE NO.	DATE

**VERIFICATION MONITORING LOCATIONS**

NSL REMEDIAL DESIGN/REMEDIAL ACTION  
NORTHSIDE SANITARY LANDFILL  
ZIONSVILLE, INDIANA

DRAWING NO.  
1-2

The liquids in the leachate/groundwater recovery system will be sampled from the sump of the collection system lift station. Five monitor wells will be installed as part of the RA program as shown on Figure 1-2. One of these wells is considered a background well and is located in the northeastern part of the site. A second well will be installed in the northwestern part of the site. The purpose of this well is to identify any contaminants that may be discharged from the northern landfilling operation facility and not to assess the performance of the NSL trust recovery system. Three additional monitor wells will be located in a generally downgradient direction. One monitor well will be installed in the southwest corner of the site, between the hydraulic isolation wall and Finley Creek, to monitor the effectiveness of the RA system. Monitor wells will also be located near the end-points of the isolation wall on the northwest and southeast corners of the NSL to verify that the RA system is not forcing contaminated ground water around the end of the isolation wall.

As discussed in the VMP, quarterly field measurements will be made and recorded from each gas vent installed for flow rate, total volatile organics, and methane. These measurements will be used to evaluate the active volume and potential impacts of the gas releases. At the end of the first and second year of post-construction monitoring, the three vents with the most significant average values of recorded data will be identified. Air samples from these three vents will be collected, transported, and analyzed by a laboratory for the Air Target List Compounds (Volatiles).

### **1.3 GROUNDWATER AND RECOVERED LEACHATE ANALYSES**

The five groundwater monitor wells and recovered leachate/groundwater from the designated collection system lift station will be sampled for the NSL Target List compounds listed in Table 3-1. These constituents represent the primary constituents of concern as established by the remediation standards included in the SOW.

A landfill gas investigation using both field and analytical techniques will be conducted at the NSL site. Chemical and physical characterizations of the landfill gas will be conducted using field techniques to evaluate flow rate, methane, and total volatile organic compounds of the landfill gas during the monitoring program. Additional chemical analysis of the landfill gas will be sampled for the NSL Target List compounds listed in Table 3-2. These constituents represent the primary constituents of concern as established by the remediation standards included in the SOW.

#### **1.4 SAMPLING PROGRAM DESIGN AND RATIONALE**

The sampling program design and rationale for sample locations are described in detail in Sections 2.0 and 3.0 of the Verification Monitoring Plan (VMP). Proposed locations for investigation activities are presented in Figure 1-2.

#### **1.5 PARAMETERS TO BE TESTED AND FREQUENCY**

The five groundwater monitor wells and recovered leachate/groundwater from the designated collection system lift station will be sampled for the NSL Target List compounds listed in Table 3-1. These constituents represent the primary constituents of concern as established by the remediation standards included in the SOW.

The sampling frequency will be semi-annually for the first year of RA system operation. The first event will be scheduled once the RA construction activities have been completed and approved by the USEPA. Monitoring data will be analyzed at the end of the first year of sampling to identify the appropriate and adequate sampling frequency for the remainder of the verification monitoring period. At the discretion of the NSL Trust and with USEPA approval, the sampling frequency may be increased or decreased as appropriate.

Twenty-seven landfill gas monitoring points have been designated to monitor flow rate, methane, and total volatile organic compounds. These 27 points will be monitored, using a field analytical technique, on a quarterly basis for the first and second year. Monitoring data will be analyzed at the end of the second year of sampling to identify the appropriate and adequate sampling frequency for the remainder of the verification monitoring period. Based on the results of the quarterly field monitoring program, at the end of the first and second years, three points will be selected for laboratory analysis of the constituents listed in Table 3-2. These constituents represent the primary constituents of concern as established by the remediation standards included in the SOW. The frequency of the quarterly field analytical and annual laboratory monitoring of the landfill gas sampling points will continue after the second year at the discretion of the NSL Trust and with USEPA approval in order to document the effectiveness of the remedy.

Sample matrices, analytical parameters and quantities of sample collection can be found in Table 1-1. Field quality control samples and frequencies of sample collection are also included in Table 1-1.

## **1.6 DATA QUALITY OBJECTIVES**

Data Quality Objectives (DQOs) are qualitative and quantitative statements which specify the quality of the data required to support decisions made during the RD/RA activities and are based on the end uses of the data to be collected. As such, different data uses may require different levels of data defensibility. All analytical data should be developed under complete and competent analytical protocols. However, because data defensibility needs may vary from one set of samples to another, the level of effort in generating quality assurance support documentation also will vary. The required defensibility needs are defined by the data quality objectives. The DQOs selected for this project were derived from the protocols published in the guidance manual "Data Quality Objectives for Remedial Response Activities", EPA/540/6-87/003, March 1987. Data



Table 1-1. Constituents, Methods of Analysis, and Quantity of Samples; QAPJP for Verification Monitoring Plan; Northside Sanitary Landfill; Zionsville, Indiana.

Constituent Group	Ground-Water Leachate		Landfill Gas		QC Sample Frequency <sup>5</sup>			
	Method	Quantity	Method	Quantity	Equipment Blanks	Field Blanks	Trip Blanks	Field Replicates
NSL Target List Volatile Organic Compounds <sup>1</sup>	CLP <sup>4</sup>	5	TO14/B240M <sup>2</sup>	3	1	1	1/cooler	1
NSL Target List Base-Neutral and Acid Extractable Compounds <sup>3</sup>	CLP <sup>4</sup>	5	--	--	1	1	--	1
Inorganics								
Aluminum	--	--	--	--	1	1	--	1
Antimony	--	--	--	--	1	1	--	1
Arsenic	CLP <sup>4</sup>	5	--	--	1	1	--	1
Barium	--	--	--	--	1	1	--	1
Beryllium	--	--	--	--	1	1	--	1
Cadmium	--	--	--	--	1	1	--	1
Calcium	--	--	--	--	1	1	--	1
Chromium	--	--	--	--	1	1	--	1
Cobalt	--	--	--	--	1	1	--	1
Copper	CLP <sup>4</sup>	5	--	--	1	1	--	1
Iron	CLP <sup>4</sup>	5	--	--	1	1	--	1
Lead	CLP <sup>4</sup>	5	--	--	1	1	--	1
Magnesium	--	--	--	--	1	1	--	1
Manganese	--	--	--	--	1	1	--	1
Mercury	--	--	--	--	1	1	--	1
Nickel	CLP <sup>4</sup>	5	--	--	1	1	--	1
Potassium	--	--	--	--	1	1	--	1
Selenium	--	--	--	--	1	1	--	1
Silver	--	--	--	--	1	1	--	1
Sodium	--	--	--	--	1	1	--	1
Thallium	--	--	--	--	1	1	--	1
Vanadium	--	--	--	--	1	1	--	1
Zinc	CLP <sup>4</sup>	5	--	--	1	1	--	1
Cyanide	CLP <sup>4</sup> /9012	5	--	--	1	1	--	1
Ammonia	350.1 <sup>6</sup>	5	--	--	1	1	--	1
Chloride	325.2 <sup>6</sup>	5	--	--	1	1	--	1
Hexavalent Chromium	7196 <sup>6</sup>	5	--	--	1	1	--	1

<sup>1</sup> Volatile Organic Compounds (VOCs) to be analyzed are the Target Compound List (TCL) presented in Tables 3-1 and 3-2.

<sup>2</sup> Volatile Organic Compounds (VOCs) in Table 3-2 analyzed by Method TO14/B240M (GC/MS) according to Compendium of Methods for the Determination of Toxic Organic Compounds in Ambient Air.

<sup>3</sup> Semi-Volatile Organic Compounds to be analyzed are presented in Table 3-1.

<sup>4</sup> EPA Contract Laboratory Program (CLP) methods to be analyzed using detection limits specified in Table 3-1.

<sup>5</sup> QC sample quantities include 1 sample for each matrix analyzed.

<sup>6</sup> EPA non-Contract Laboratory Program (CLP) methods - sample preparation and analysis will be in accordance with procedures specified by EPA methodology.

quality objectives are based upon the end uses of the data. USEPA has specified five (5) DQO levels in the referenced document which relate various data uses with the appropriate QA/QC effort and methods required to achieve a specified level of quality. These levels are:

- o USEPA Level I - Field screening or analysis using portable instrumentation. Level I can provide indication of contamination if instruments are calibrated properly and data used correctly. Level I is applicable to data generated on-site through the use of the organic vapor analyzer<sup>TM</sup> (OVA), pH, conductivity, and other real-time monitoring equipment at the site as initial site characterization preliminary to subsequent and more accurate analyses. This level will include data generated from the monitoring well and landfill gases screening.
- o USEPA Level II - Field analyses using sophisticated portable analytical instruments. Data quality varies with quality control procedures and the skill of the instrument operator.
- o USEPA Level III - all analyses are performed in an off-site analytical laboratory. The laboratory may or may not be a CLP laboratory. Detection limits are similar to CLP and the data can be of the same quality. Level III will include data generated from leachate/groundwater sampling for inorganic analyses.
- o USEPA Level IV - CLP Routine Analytical Services. All analyses are performed in an off-site CLP laboratory following CLP procedures. Level IV is characterized by rigorous QA/QC protocols and documentation. These analyses will be used for purposes of evaluation of remedial alternatives and Potentially Responsible Parties (PRP) determinations. Level IV data will be generated from leachate/groundwater sampling and analysis for organic and metals analyses.
- o USEPA Level V - Analysis by non-standard methods. All analyses are performed in an off-site analytical laboratory which may or may not be a CLP laboratory. Level V data will be generated from annual landfill gas analysis.

The DQO Levels required for this project are summarized in Table 1-2.

Table 1-2. Data Quality Objectives for Field and Laboratory Parameters; QAPjP for Verification Monitoring Plan; Northside Sanitary Landfill; Zionsville, Indiana.

Location	Parameter	EPA DQO Level
Field		
	pH	I
	Specific Conductivity	I
	Temperature	I
	Organic Vapor Analyzer	I
	Explosimeter/Oxygen Meter	I
Laboratory		
	NSL VOCs	IV
	NSL BNAs	IV
	NSL Metals	IV
	NSL Gas VOCs	V
	NSL Ammonia, Chloride	III

<sup>1</sup> EPA DQO Levels as defined in Section 1.6

## **1.7 PROJECT SCHEDULE**

The schedule for sample collection to be performed during the Verification Monitoring Investigation will be defined once the RA construction activities have been completed and approved by the USEPA. The sampling frequency for leachate/groundwater will be semiannually for the first year of the RA system operation. Frequency of the gas monitoring program will be quarterly field testing and annual laboratory analysis for the first two years of the RA system operation. At the discretion of the NSL Trust and with USEPA approval, the sampling frequency may be altered in order to document the effectiveness of the remedy and support the anticipated request to terminate the system operation.

## **2.0 PROJECT ORGANIZATION AND RESPONSIBILITY**

At the direction of the NSL Trustees, de maximis, inc. has overall responsibility for coordination and management of the VMP. This section provides a description of the organizational structure of personnel to be used on this project. This description illustrates the lines of authority and identifies the key positions assigned to various activities for the project. A proposed organizational structure chart for the investigation is shown in Figure 2-1. Where known, specific personnel assigned to these positions are also identified. Additional personnel assignments will be identified as a supplement to this QAPjP when available.

### **2.1 NORTHSIDE SANITARY LANDFILL TRUSTEES**

The PRPs for NSL have appointed three (3) Trustees who have been delegated the authority to carry out the consent decree requirements as specified in the SOW.

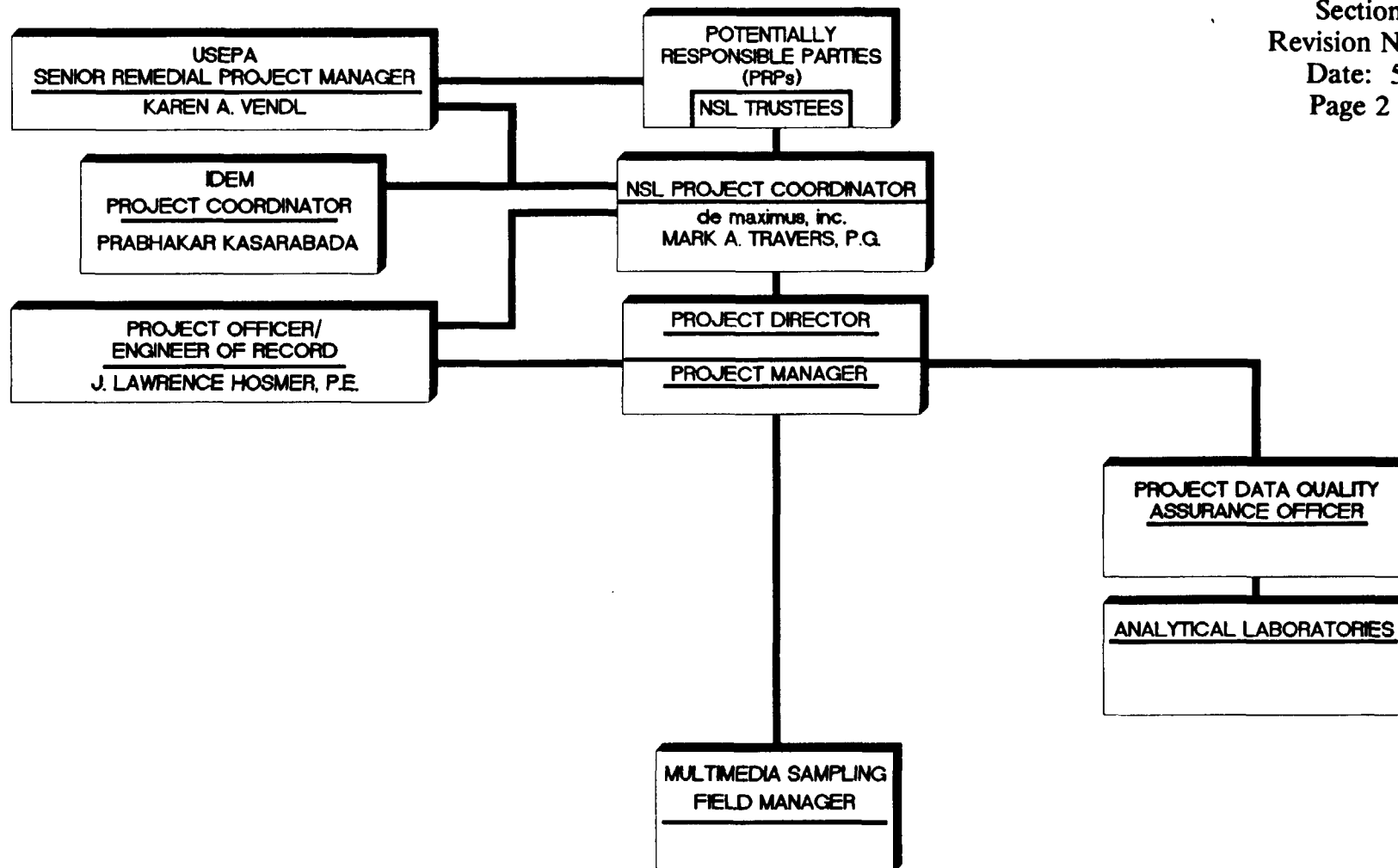
### **2.2 NSL PROJECT COORDINATOR**

The Project Coordinator with primary responsibility for implementation of the remedy will be Mr. Mark A. Travers, P.G. of de maximis, inc. The Project Coordinator will provide support and an independent QA review of the products supplied. Additionally, de maximis, inc. will review all documents and deliverables prior to submittal to USEPA.

### **2.3 PROJECT DIRECTOR**

The Project Director will be assigned following construction of the RA. The Project Director will act as a focal point for coordination and dissemination of information from the various groups involved with the project.

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## **2.4 PROJECT OFFICER/ENGINEER-OF-RECORD**

The Project Officer/Engineer of Record for the Design was Mr. J. Lawrence Hosmer, P.E. Mr. Hosmer was responsible for the overall quality of the entire RD project and its deliverables. Mr. Hosmer's role during the RA activities will be defined as part of the supplemental information to be provided.

## **2.5 PROJECT MANAGER**

The Project Manager will be assigned following completion of the RA. Duties performed as required during the RD may include:

- 1) Approval of project-specific procedures and internally prepared plans, drawings, and reports;
- 2) Ensuring that the technical, schedule, and control requirements established by the QA Officer are enforced on the project;
- 3) Serving as the "collection point" for the project staff reporting any changes or deviations from the project work plan;
- 4) Determining the significance of these changes or deviations to the work plan, and the appropriateness for reporting such items to the appropriate regulatory representative;
- 5) Arranging subcontractor services;
- 6) Assigning duties to the project staff and orientation of the staff to the requirements of the project; and
- 7) Preparation of status update reports and revisions to the project work plan.

## **2.6 PROJECT DATA QUALITY ASSURANCE OFFICER**

The Project Data Quality Assurance Officer (QA Officer) will be assigned following completion of the RA. The QA Officer will be the liaison between the designated contract laboratory/laboratories, Project Director, and NSL Trustees. The QA Officer will remain independent of direct job involvement and day-to-day operations, and has direct access to corporate executive staff as necessary to resolve any QA dispute. He is responsible for auditing the implementation of the QA program in conformance with the demands of specific investigations, policies, and USEPA requirements. The QA Officer will ensure the accuracy of the collected data through the performance of the following tasks:

- 1) Field and laboratory systems and performance audits;
- 2) Field sample collection and analytical QA program design;
- 3) Field and analytical data validation;
- 4) Selection of the analytical laboratory; and
- 5) Preparation of laboratory contracts.

## **2.7 ANALYTICAL LABORATORY/LABORATORIES**

One or more environmental laboratories will be selected to act as the designated contract analytical laboratory/laboratories for this project. The designated contract laboratory/laboratories will conduct chemical analysis of the leachate/groundwater and/or landfill gas analyses in accordance with the required protocols of the project and as stated within the approved Verification Monitoring Plan QAPjP.

The primary laboratory liaison for the VMP will be responsible for reviewing all analytical reports from the laboratory to ensure: (1) data quality objectives have been met; (2) all requested work has been completed; (3) all reports have identical format; (4) quality assurance reporting requirements are complete; and, (5) timely delivery of the proper



number of report copies to the designated recipients. He also will be indirectly involved with sample receipt, log-in and tracking, analysis, quality assurance, report preparation, and initial review.

The laboratory QA Officer is responsible for the establishment of quality assurance programs within the laboratory to ensure consistency, accuracy, and precision in the analysis of samples. He also is responsible for internal laboratory data validation programs and quality assurance audits.

Qualifications of the designated contract laboratory/laboratories personnel will be provided in their Comprehensive Quality Assurance Plan (CompQAP) prior to completion of the RA.

### **3.0 QUALITY ASSURANCE OBJECTIVES FOR MEASUREMENT DATA**

#### **3.1 QUALITY CONTROL OBJECTIVES**

The overall QA objective is to develop and implement procedures for field sampling, chain-of-custody, laboratory analysis, and reporting that will provide data that will be suitable for project purposes and, where necessary legally defensible in a court of law. The purpose of this section is to address the specific data quality objectives (DQOs) for measurement data generated in field and laboratory analyses in terms of precision, accuracy, representativeness, completeness, and comparability. These five measurement DQOs are often referred to by the acronym PARCC. To these DQOs are added method detection limits, and EPA DQO level of performance. All measurements will be made so as to yield consistent results representative of the media and conditions measured and reflective of the project objectives. All data will be reported in units consistent to allow comparability of data bases with those of other agencies and organizations.

The selection of the appropriate level of reporting for any investigation is based upon data defensibility needs, i.e., the probability of defending the data in a court of law or before a regulatory agency. The existence of levels of reporting or DQO Levels does not mean to imply that in low risk situations, analyses may be of lesser competence. On the contrary, analyses should always conform to complete performance requirements as specified by the method. This means that fundamentally all analyses should include six basic QC parameters:

1. Instrument calibration after Tuning (if required)
2. Initial and continuing calibration verification
3. System contamination checks (blanks)

4. Analytical System Accuracy Checks, eg.,
  - \* Laboratory Control Samples
  - \* Reagent Water Blank Spikes
  - \* Linear Range Check Standard
5. Analytical System Precision Checks, eg.,
  - \* Laboratory Duplicate Samples
  - \* Reagent Water Blank Spike Duplicates
6. Matrix and System Interference Checks
  - \* Matrix spikes
  - \* Surrogate spikes
  - \* Internal Standard Checks
  - \* Interference Check Standards

There is really only one level of analytical performance, i.e., a complete analysis run based on the required level of defensibility. For this project, the USEPA DQO levels have been referenced throughout.

As previously mentioned, the USEPA DQOs for field and laboratory generated data associated with this project are presented in Table 1-2. Ancillary DQOs, associated with sample handling procedures (eg., holding times, container types, sample preservation, etc.) are presented in Section 4.0 in Table 4-1. The definitions, development, and interpretation for each PARCC DQO parameter and method detection limits are presented in the subsections below. The fundamental QA objectives for accuracy, precision, and sensitivity (detection limits) for field and laboratory analytical data will be achieved by meeting the QC acceptance criteria defined by the analytical protocols. Those parameters being analyzed by the USEPA Contract Laboratory Program (CLP) protocols will employ CLP DQOs for precision and accuracy. DQOs for the other non-CLP parameters (Landfill gas volatile organic constituents) also listed will employ DQOs for precision and accuracy from the Compendium of Methods for the Determination of Toxic Organic Compounds in Ambient Air as generated internally by the subcontracted laboratory. DQOs for the listed field parameters are based on experience with the field instruments while employing manufacturers recommended procedures.

Tables 3-1 to 3-2 present the target compounds of interest for the investigations, including organic and inorganic analyses. Analysis of the leachate/groundwater collected by the contractor will be performed by designated contract laboratories, in accordance with protocols and QA procedures established by USEPA 3/90 CLP SOW, OLM01.6 and ILM01, methodologies. Selected organic and inorganic target constituent lists that will be analyzed by the laboratory following these method protocols are included in Table 3-1.

Analysis of landfill gas samples collected by the contractor will be performed by designated contract in accordance with protocols and QA procedures established by the Compendium of Air Toxins methodologies. The specific organic target constituent list that will be analyzed by the laboratory following these method protocols are included in Table 3-2. SOPs for field measurements of pH, conductivity, temperature, organic vapor analyzer, and explosimeter are outlined in the VMP and in Table 3-3 of this document. These protocols include statements for accuracy, precision and sensitivity.

Field blank, trip blank, duplicate and matrix spike samples will be analyzed to assess the quality of the data resulting from the field sampling program. Field and trip blanks that consist of distilled water, or air will be submitted to the analytical laboratory/laboratories to provide the means to assess the quality of the data resulting from the field sampling program. Field blank samples are analyzed to check for contaminant introduction at the site which may cause analyte bias during analysis. Trip blanks are used to assess the potential for contaminant introduction of samples due to analyte migration during sample shipment and storage. Duplicate samples are analyzed to check for sampling and analytical reproducibility. Matrix spikes provide information about the effect of the sample matrix on the digestion and measurement methodology. All matrix spikes are performed in duplicate and are hereinafter referred to as MS/MSD samples. MS/MSD samples are designated for each method of analyses performed by the designated contract laboratory/laboratories.

Table 3-1. NSL Target Constituent List for Leachate/Groundwater Samples; QAPjP for Verification Monitoring Plan; Northside Sanitary Landfill; Zionsville, Indiana.

Constituents	CAS Number	Quantitation Limits <sup>1</sup> (ug/L)
<b><u>VOLATILE ORGANICS</u></b>		
Benzene	71-43-2	40
Chloroform	67-66-3	15.7
1,2-Dichloroethane	107-06-2	243
1,1-Dichloroethene	75-35-4	5
Ethyl Benzene	100-41-4	3280
Methylene Chloride <sup>2</sup>	75-09-2	15.7
Tetrachloroethene	127-18-4	8.85
Toluene <sup>2</sup>	108-88-3	3400
1,1,1-Trichloroethane	71-55-6	5280
1,1,2-Trichloroethane	79-00-5	41.8
Trichloroethene	79-01-6	80.7
Vinyl Chloride	75-01-4	525
<b><u>SEMIVOLATILES</u></b>		
Phenol	108-95-2	570
Naphthalene	91-20-3	620
4-Chloro-3-Methylphenol <sup>3</sup>	59-50-7	10
Dimethyl Phthalate	131-11-3	33,000
Diethyl Phthalate	84-66-2	52,000
Di-n-Butyl Phthalate	84-74-2	154,000
Bis(2-Ethylhexyl) Phthalate	117-81-7	50,000

Table 3-1. NSL Target Constituent List for Leachate/Groundwater Samples; QAPjP for Verification Monitoring Plan; Northside Sanitary Landfill; Zionsville, Indiana.

Constituents		CAS Number	Quantitation Limits <sup>1</sup> (ug/L)
<b><u>METALS/INORGANICS</u></b>			
Arsenic <sup>3</sup>	As	7040	5
Chromium(VI)	Cr	7196	11
Copper	Cu	6010	26
Iron	Fe	6010	1,000
Lead	Pb	7421	10
Nickel	Ni	6010	100
Zinc	Zn	6010	47
Cyanide	as CN	9012	5.2
Ammonia	as N	350.1	1,140
Chloride	as Cl	325.2	230,000

Note: <sup>1</sup> The Achievable Quantitation Limits for these compounds are in accordance with the Remedial Standards specified in the Work Plan.

<sup>2</sup> Common laboratory solvent. Control limits for blanks are 5 times the method detection limits.

<sup>3</sup> The Achievable Quantitation Limits for these compounds exceed the Remedial Standards specified in the Work Plan.

**Table 3-2. NSL Target Constituent List for Landfill Gas Samples; QAPjP for Verification Monitoring Plan; Northside Sanitary Landfill; Zionsville, Indiana.**

Volatile Organics	CAS Number	Quantitation Limits (ug/M <sup>3</sup> )
Benzene	71-43-2	30
Chloroform	67-66-3	30
1,2-Dichloroethane	107-06-2	30
1,1-Dichloroethene	75-35-4	30
Ethyl Benzene	100-41-4	30
Methylene Chloride <sup>1</sup>	75-09-2	70
Tetrachloroethene	127-18-4	30
Toluene <sup>1</sup>	108-88-3	30
1,1,1-Trichloroethane	71-55-6	30
1,1,2-Trichloroethane	79-00-5	30
Trichloroethene	79-01-6	30
Vinyl Chloride	75-01-4	30

**Note: <sup>1</sup>** Common laboratory solvent. Control limits for blanks are 5 times the method detection limits.

**Table 3-3. QA Frequency and Objectives for Field Measurements; QAPjP Verification Monitoring Plans; Northside Sanitary Landfill; Zionsville, Indiana.**

Parameter	Analyses Method	Precision	Accuracy (Recovery)	Completeness %
pH	150.1	0.05 units	$\pm 0.2$ units	95
Conductivity	120.1	7.6 umhos/cm	$\pm 2\%$	95
Temperature	170.1	0.1°C	$\pm 0.2^\circ\text{C}$	95
Total Organic Vapors/ Methane	OVA	20%	$\pm 25\%$	90
Explosive Gases/Oxygen	O <sub>2</sub> /LEL	20%	$\pm 25\%$	90
QA Sample Frequency Analysis	Initial Calibration	Calibration Check	Sample Duplicate	
pH	Daily	Every 4 hrs	Daily	
Cond.	Daily	Every 4 hrs	Daily	
Total Organic Vapors/ Methane	Daily	Every 4 hrs	--	
Explosive Gases/ Oxygen	Daily	Every 4 hrs	--	



The general level of the QC effort will be one field duplicate and one field blank for every 20 or fewer investigative samples. One trip blank consisting of distilled, deionized, and ultra-pure water will be included along with each shipment of VOC samples. The number of duplicate and field blank samples to be collected are listed in Table 1-1. Sampling procedures are specified in the VMP. One MS/MSD sample will be collected/designated for every 20 or fewer investigative samples per sample matrix (i.e., leachate/groundwater and air).

The contracted environmental laboratories will report practical quantitation limits (PQLs) established for the methods as presented in the appropriate USEPA document or as stated in Table 3-1 to 3-2 as appropriate. PQLs, however, are based on method detection limits (MDLs) that have been adjusted to allow for variations in the sample matrix type. Contract laboratory specific method detection limits and practical quantitation limits are presented in each laboratories's CompQAP.

Instances may occur when the condition of the sample will not permit attainment of the desired detection limits for various parameters, regardless of the selected method, either because of matrix interferences or high analyte concentrations requiring sample dilution. Since detection limits for air monitoring are dependent on the volume of air sampled, the method detection limits specified may vary. When a matrix interference is suspected in an initial analysis of a sample for an inorganic or metal analyte, the EPA CLP laboratory program requires the laboratory to re-digest or otherwise re-prepare the sample and reanalyze one time. This re-preparation and reanalysis procedure is not required for organic analyses provided other QC parameters (surrogate spike and internal standards) show acceptable performance. In this instance, an out-of-control matrix spike recovery is considered to be acceptable and attributable to a matrix effect. However, not withholding these foregoing procedures, the laboratory also will be required to prepare and analyze a non-interfered analytical reagent water blank spike of the matrix spike compounds and

analyze it with the field samples. Acceptable recovery of matrix spike compounds in the blank spike with out-of-control recovery of the matrix spike compounds in the sample(s) will be adequate evidence of a true matrix interference. Samples associated with matrix interferences will be appropriately flagged (qualified) during data validation in accordance with the EPA Laboratory Data Validation Functional Guidelines for Organics and Inorganic analyses as appropriate.

When analyte concentrations in the sample are so high that dilution of the sample is required for quantitation of resolved peaks or isolated instrument responses, the laboratory will ensure that the dilution factor will be the lowest possible dilution to effect sample analysis. No additional efforts beyond this practice are presently available to be performed that will effectively ameliorate this circumstance.

### **3.2 PRECISION**

PRECISION is the degree of mutual agreement of independent measurements as a result of repeated application of a process under specific conditions. This means that precision is a measure of the reproducibility of a given measurement system; that is precision is concerned with the closeness of results during repeated analysis of the same sample. Precision objectives for analysis of sediment and water samples for each method in terms of the RELATIVE PERCENT DIFFERENCE (RPD) of duplicate measurements have been specified for field measurements in Table 3-3 and for laboratory/laboratories measurements in each respective CompQAP.

Examples of QC samples that will be used to evaluate precision in the laboratory/laboratories may include:

- \* Laboratory duplicates;
- \* Reagent water blank spike duplicates;

- \* Matrix spike duplicates; and
- \* Field duplicates.

Examples of QC samples that will be used to evaluate precision in field measurements may include:

- \* Duplicate analysis of samples; and
- \* Duplicate analysis of a known control sample.

### **3.3 ACCURACY**

**ACCURACY** is the degree of agreement of a measured value with true or expected value. Accuracy objectives for analysis of sediment and water samples for each method in terms of the percent Recovery (%R) from analysis of samples of known analyte concentration are presented in each respective CompQAP.

Examples of QC samples that will be analyzed to evaluate accuracy in laboratory/laboratories measurements include:

- \* Laboratory control samples;
- \* Matrix spikes;
- \* Initial and continuing calibration verification standards; and
- \* Reagent water blank spikes.

Examples of QC samples that will be analyzed to evaluate accuracy in field measurements include:

- \* pH buffers of known pH; and
- \* Conductivity standards of known conductivity.

### **3.4 REPRESENTATIVENESS**

REPRESENTATIVENESS expresses the degree to which data accurately and precisely represent a characteristic of a population, parameter variations at a sampling point, a process condition, or an environmental condition. As such, representativeness describes whether samples collected, or the aliquot selected by the laboratory for analysis are sufficient in number, type, location, frequency and size to be characteristic of the substance we are trying to analyze.

Representativeness is a qualitative parameter which is dependent upon the proper design of the sampling program and proper laboratory protocol. The sampling network for this project was designed to provide data representative of site conditions. During development of this network, consideration was given to past waste disposal practices, existing analytical data, physical setting and processes, and constraints inherent to the investigation process. The rationale of the sampling network is discussed in detail in the VMP. Representativeness will be satisfied by insuring that the VMP is followed, proper sampling techniques are used, proper analytical procedures are followed and holding times of the samples are not exceeded in the laboratory/laboratories. Representativeness will be assessed by the analysis of field duplicated samples.

### **3.5 COMPLETENESS**

COMPLETENESS is a measure of the amount of valid data obtained from a measurement system compared to the amount that was expected to be obtained under the conditions of the measurement. It is expected that the designated contract laboratory/laboratories will provide data meeting QC acceptance criteria for 90 percent or more for all samples tested using the methods defined in Tables 3-1 and 3-2. Following completion of the analytical testing, the percent completeness will be calculated by the following equations:

$$\text{completeness (\%)} = \frac{(\text{number of valid QC Samples})}{(\text{number of QC samples analyzed for each analytical run})} \times 100$$

In the event the desired level of completeness is not obtained, corrective action steps as outlined in Section 13.0 will be initiated.

### **3.6 COMPARABILITY**

COMPARABILITY expresses the confidence with which one data set can be compared with another. The extent to which existing and planned analytical data will be comparable depends on the similarity of sampling and analytical methods. The procedures used to obtain the planned analytical data, as documented in the QAPjP, are expected to provide comparable data, i.e., data that may be compared to previously generated data bases. However, it must be recognized that for different data sets to be truly comparable, all aspects of the collection and measurement process should be identical. Some of the parameters that should be consistent to ensure comparability include the following:

- \* Samples must be from the same source;
- \* Samples must be collected in the same or similar manner;
- \* Samples must be preserved in the same manner;
- \* Samples must be prepared and analyzed by the same method;
- \* Data must be reported in the same units; and
- \* Data from each set must be of comparable quality.

### **3.7 ANALYTICAL HOLDING TIMES**

The elapsed time between sample collection and initiation of laboratory/laboratories sample preparation or analysis (whichever is appropriate) must be within the time frame

prescribed for each individual analysis to be performed. Required holding times for all routine samples collected as described in 40 CFR 136.3 Table II, are specified in Table 4-1. In all cases, holding times are measured starting from the date and time of sample collection to the date and time of sample preparation and/or analysis, whichever is applicable. Holding times are not measured from the date or time of sample receipt by the laboratory.

### **3.8 REQUIRED DETECTION LIMITS**

Detection limits required for this project have been specified for leachate/groundwater and landfill gas constituents in Tables 3-1 and 3-2. Detection limits required for the work will be the method detection limits unless specified otherwise by USEPA and agreed to by the laboratory. The laboratory is required to have conducted and have a record of a baseline detection limit study for all methods. This study is required to be periodically updated and/or revised when changes in instrumentation or methods occur within the laboratory. This study is intended to establish accordance with accepted regulatory procedures, the baseline (lowest possible) method detection limits (MDLs) and instrument detection limits (IDLs) obtainable by the laboratory/laboratories. It is not intended that detection limit studies be conducted for this project specifically. However, the laboratory is required to have available the results of its most recent detection limit study for the analytes in question in this project. With the exception of demonstrated matrix interferences or sample dilution/concentration requirements, the laboratory is required at any time to be able to demonstrate the ability to achieve the detection limits stated in the analytical reports generated by the analysis of samples submitted from the NSL site. In the laboratory data packages, the laboratory must report detection limits at or below the limits described in this QAPjP, unless the specified detection limits are not obtainable by the laboratory due to high parameter concentrations requiring sample dilution or matrix interferences.

## **4.0 SAMPLING PROCEDURES**

The quality of the data collected in an environmental study depends on the quality of the sampling activities. Therefore, field operations will be carefully planned and implemented. Procedures for sample handling, preservation, shipping and storage are described in the following sections. Detailed descriptions of site selection, sample collection, and field screening methods for the verification monitoring program are described in the Verification Monitoring Plan.

### **4.1 GENERAL SAMPLING PROCEDURES**

Sampling for groundwater will be accomplished in accordance with protocols described in the USEPA Region V SOP/QAM. Landfill gases (air) sampling will be conducted in accordance with established protocols as outlined in the "Compendium of Methods for the Determination of Toxic Organics in Ambient Air, 1984".

#### **4.1.1 Types of Samples**

Samples collected for laboratory analysis will consist of groundwater from monitoring wells and landfill gas from the vents. The number of samples of each matrix to be collected are described in Section 2.0 and the Verification Monitoring Plan. The number of pertinent field QC samples required to be submitted during the verification monitoring program are presented in Table 1-1.

#### **4.1.2 Sample Containers**

Sample containers supplied by the laboratories for the collection of groundwater and landfill gases will be new, pre-cleaned, and pre-baked according to the procedures specified in the analytical methods.

Three levels of contamination have been defined as follows:

- o Low level samples are considered to be those collected off-site, around the perimeter of a waste site, or in areas where hazards are thought to be significantly reduced by normal environmental dilution, attenuation, and degradation processes.
- o Medium level samples are commonly those collected in areas of moderate dilution by normal environmental processes.
- o High level samples include those in drums, surface impoundments, direct discharges, and chemical spills where there is little or no evidence of environmental dilution. High level samples are suspected to contain greater than 15% concentration of any individual chemical constituent.

It is anticipated that the majority of samples collected for this investigation will be classified as low level samples.

Table 4-1 summarizes the sample containers and preservation procedures required for each type of sample. Sample containers will be kept closed and in the cooler until use.

#### **4.1.3 Sample Labels and Sampling Logs**

Samples collected for chemical analysis will be fully labeled at the time of collection. At a minimum, the sample label information will include the sample identification, the date



Table 4-1. Laboratory Sample Container, Preservative, and Holding Time Specifications; QAPjP for Verification Monitoring Plan; Northside Sanitary Landfill; Zionsville, Indiana.

Parameter	Container	Sample Preservative	Holding Time
<b><u>Ground Water/Leachate</u></b>			
Volatile Organics	Three 40-mL glass VOC vials, no headspace	1:1 HCL to pH <2, cool to 4°C	14 days
Base/Neutral/Acid Extractables	Two 1-liter amber glass bottle	Cool to 4°C	Extract in 7 days, analyze within 40 days of extraction
Metals	1-liter polyethylene bottle	HNO <sub>3</sub> to pH <2	6 months, mercury 28 days
Hexavalent Chromium	1-liter polyethylene bottle	Cool to 4°C	24 hours
Cyanide	500 mL polyethylene bottle	NaOH pH > 12, cool to 4°C	14 days
Chloride	500 mL polyethylene bottle	cool to 4°C	28 days
Ammonia	500 ml polyethylene bottle	H <sub>2</sub> SO <sub>4</sub> to pH <2 cool to 4°C	28 days
<b><u>Landfill Gas</u></b>			
Volatile Organics	Summa™ canister	none	14 days

and time of collection, sample matrix, the analyses requested, the preservatives used, and the initials of the personnel collecting the sample. An example of a sample label is shown in Figure 5-1. Sample collection data, including information contained on the labels, will be recorded in the bound field log book as the samples are collected. All recorded entries will be made in indelible ink. No erasures will be made. If an error is made, a correction may be made by drawing a line through the error, initialing the error, and starting a new entry on the next line. Sample containers will be placed on ice in coolers immediately after sampling.

A sampling log will be completed during the collection of groundwater and landfill gas samples. These logs will be completed as samples are collected. Field QC samples will be clearly identified on the appropriate field sampling log and in the field log book.

#### **4.1.4 Equipment Cleaning**

Sampling equipment cleaning procedures (pre- and post-sampling) will be conducted in accordance with procedures specified in the USEPA Region V SOP/QAM. The cleaning procedures specified in this section are to be used by sampling personnel to decontaminate sampling and other field equipment prior to field use. The specific cleaning materials and procedures for equipment decontamination are presented in the following paragraphs.

- (a) **Laboratory Detergent and Cleaning Solvent.** The laboratory detergent used for equipment decontamination will be a standard brand of phosphate-free laboratory detergent such as Alquinox<sup>TM</sup>, Liquinox<sup>TM</sup>, or Micro<sup>TM</sup>. The standard cleaning solvent shall be pesticide grade isopropanol. The use of other detergent or solvent must be approved by the contractor QA Officer, and its use must be documented in the field log books.

- (b) Cleaning Water. Tap water from any municipal water supply may be used for initial equipment rinses and steam cleaning prior to decontamination. The use of an untreated potable water supply is not an acceptable substitute for tap water.

Deionized/organic-free water will be used during cleaning procedures for field equipment after tap water rinses. Deionized/organic-free water is defined as tap water that has been treated with activated carbon and deionizing units. Deionized/organic-free water should contain no metals, inorganics, pesticides, herbicides, extractable organic compounds, and purgeable organic compounds as measured by appropriate analysis of the field and/or equipment blanks that are submitted with the samples.

Deionized/organic-free water will be used to prepare soap solutions and for final rinses during field equipment cleaning. The solvents, laboratory detergent, and rinse waters used to clean equipment shall not be reused.

- (c) Location of Decontamination Process. When possible, equipment will be decontaminated in batches at a central staging area on-site. Solutions, rinse solvents, and deionized/organic-free water will be disposed via containerization or the facility's wastewater treatment system.

#### **4.1.4.1 General Decontamination Procedure**

Non-dedicated sampling equipment (bailers, Kemmerer-type samplers, glass bowls, split spoon, stainless-steel scoops, spoons, augers, etc.) will be decontaminated using the following procedure.

1. Rinse equipment thoroughly with potable tap water or deionized/organic-free water in the field as soon as possible after use.
- 2a. If organic residues are noted on the sampling equipment, rinse equipment with isopropanol alcohol.
- 2b. Rinse equipment thoroughly with deionized/organic-free water.
3. Wash equipment thoroughly with laboratory detergent and deionized/organic-free water using a brush to remove particulate matter or surface film.
4. Rinse equipment thoroughly with deionized/organic-free water.
5. Rinse equipment twice with isopropanol.
6. Rinse equipment thoroughly with deionized/organic-free water and allow to air dry as long as possible.
7. Wrap equipment completely to prevent contamination during storage and/or transport to the unit.

#### **4.1.4.2 Equipment Storage**

Decontaminated field and sampling equipment will be stored in covered containers or wrapped in aluminum foil to minimize contamination. Decontaminated equipment shall be clearly identified by labeling the wrapping material. Field equipment and reusable sample containers needing cleaning or repairs shall not be stored with clean equipment. Field sampling equipment that needs to be repaired shall be clearly identified and the repairs shall be documented.

#### **4.1.4.3      Quality Control Procedures for Cleaning Operations**

The effectiveness of field cleaning procedures shall be monitored by collection of equipment blanks. Equipment blanks will be prepared according to the procedures specified in Section 8.0 of this QAPjP. The equipment blank is collected in the same type of sample container as the field samples, preserved in the same manner, and analyzed for parameters of interest. Equipment blanks will be collected during each sampling event and analyzed for selected chemical parameters of concern at a minimum frequency of one per 20 samples. Additional quality control samples (field blanks) may be collected to help evaluate sources of potential contamination.

#### **4.2      CHANGES IN PROCEDURES**

Any changes in the sampling procedures as outlined in this QAPjP will be discussed with the on-site coordinator to obtain technical concurrence and all changes will be documented in the field log book. Approval from the contractor Field Manager and QA Officer will be necessary to implement on-site changes and/or major modifications of the sampling design or procedures. For non-time critical decisions, the contractor will notify the USEPA Project Manager of the proposed changes in the field procedures and if possible, obtain concurrence prior to implementation. When prior notification is not possible, the USEPA Project Manager will be notified of the change in field procedures along with the justification for the change. All deviations from the Verification Monitoring Plan and QAPjP will be identified in the Report along with the justification for the change as well as an interpretation of the impact the change had on the quality of the data collected.

## **5.0 SAMPLE CUSTODY**

It is general policy to follow the chain-of-custody protocols as outlined in "NEIC Policies and Procedures", EPA-330/9-78DDI-R, Revised June 1985. This custody is in three parts: Sample collection, Laboratory analysis, and Final evidence files. Final evidence files, including all originals of laboratory/laboratories reports and purge files, are maintained under document control in a secure area.

### **5.1 FIELD CHAIN-OF-CUSTODY PROCEDURES**

The sample packaging and shipment procedures summarized below will insure that the samples will arrive at the laboratory/laboratories with the chain-of-custody intact.

#### **5.1.1 Field Procedures**

- (a) The field sampler is personally responsible for the care and custody of the samples until they are transferred or properly dispatched. As FEW people as possible should handle the samples.
- (b) All bottles will be labeled with sample numbers and locations. An example of a typical sample container label is presented in Figure 5-1.
- (c) Sample labels are to be completed for each sample using waterproof ink unless prohibited by weather conditions. For example, a logbook notation would explain that a pencil was used to fill out the sample tag because the ballpoint pen would not function in freezing weather.

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Revision No. 0  
Date: 5/94  
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		SAMPLE I.D.	
PROJECT #			DATE
SAMPLE TYPE <input type="checkbox"/> Soil/Sediment <input type="checkbox"/> Water	COLLECTION MODE <input type="checkbox"/> Composite <input type="checkbox"/> Grab	TIME	
ANALYSIS			
SAMPLER(S)		PRESERVATIVE	

SCALE  
N.T.S.



**GERAGHTY  
& MILLER, INC.**  
*Environmental Services*

**EXAMPLE: SAMPLE CONTAINER LABEL**  
QUALITY ASSURANCE PROJECT PLAN  
VERIFICATION MONITORING PLAN  
NORTHSIDE SANITARY LANDFILL  
ZIONSVILLE, INDIANA

FIGURE

5-1

- (d) The Project Manager will review all field activities to determine whether proper custody procedures were followed during the field work and decide if additional samples are required.

### **5.1.2 Field Logbooks/Documentation**

The field logbook will provide the means of recording the data collection activities performed. As such, entries will be described in as much detail as possible so that persons going to the site could re-construct a particular situation without reliance on memory. Field logbooks will be bound, field survey books or notebooks.

The title page of each logbook will contain the following:

- \* Person to whom the logbook is assigned,
- \* Logbook number,
- \* Project name,
- \* Project start date, and
- \* End date.

Entries into the logbook will contain a variety of information. At the beginning of each entry, the date, start time, weather, names of all sampling team members present, level of personal protection being used, and the signature of the person making the entry will be entered. The names of visitors to the site, field sampling or investigation team personnel and the purpose of their visit will also be recorded in the field logbook. In addition to the information contained in the field logbook, sample/core logs, well completion logs, water sampling logs, and air sampling logs may be completed for each activity or sample collected. All loose-leaf log sheets will be arranged in sequential order and bound together upon completion of each sampling event.



Measurements made and samples collected will be recorded on the field logs. All entries will be made in ink and no erasures will be made. If an incorrect entry is made, the information will be crossed out with a single strike mark. Whenever a sample is collected, or a measurement is made, a detailed description of the location of the station, shall be recorded. The number of the photographs taken of the station, if any, will also be noted. All equipment used to make measurements will be identified, along with the date of calibration.

Samples will be collected following the sampling procedures documented in the VMP. The equipment used to collect samples will be noted, along with the time of sampling, sample description, depth at which the sample was collected, volume and number of containers. Sample identification numbers will be assigned prior to sample collection. Field duplicate samples, which will receive an entirely separate sample identification number, will be noted under sample description.

### **5.1.3 Transfer of Custody and Shipment Procedures**

All samples will be maintained in the custody of the sampling personnel. At the end of each sampling day and prior to the transfer of the samples off-site, chain-of-custody entries will be made for all samples using a standard chain-of-custody form (an example form is illustrated in Figure 5-2). All information on the chain-of-custody form and the sample container labels will be checked against the sample field log entries and samples will be recounted before leaving the sampling site. Upon transfer of custody, the chain-of-custody form will be signed

Project Number \_\_\_\_\_

Project Location \_\_\_\_\_

Laboratory \_\_\_\_\_

**Sampler(s)/Affiliation** \_\_\_\_\_

## SAMPLE BOTTLE / CONTAINER DESCRIPTION

SAMPLE IDENTITY	Code	Date/Time Sampled	Lab ID
-----------------	------	----------------------	--------

TOTAL

Sample Code: L = Liquid; S = Solid; A = Air

Total No. of Bottles/  
Containers

Relinquished by: \_\_\_\_\_

**Organization:**

Received by:

**Organization:**

Date      /      /      Time     

	Seal Intact?
	Yes No N/A
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Relinquished by: \_\_\_\_\_

**Organization:**

Received by:

**Organization:**

Date 1/1 Time     

	Seal Intact?
	Yes No N/A
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Special Instructions/Remarks:

**Delivery Method:**

☐ In Person☐ Common Carrier

**SPECIFY**

☐ Lab Courier☐ Other

**REPLY**

Exempt 90-0138

**SCALE**  
**N.T.S**



**GERAGHTY  
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*Environmental Services*

### EXAMPLE: CHAIN-OF-CUSTODY RECORD

## QUALITY ASSURANCE PROJECT PLAN

## VERIFICATION MONITORING PLAN

NORTHSIDE SANITARY LANDFILL

ZIONSVILLE, INDIANA

## FIGURE

5-2

and dated by the sample team leader. When transferring the possession of samples, the individuals relinquishing and receiving will sign, date, and note the time on the record. This record documents transfer of custody of samples from the sampler to another person, to a mobile laboratory, to the permanent laboratory/laboratories, or to/from a secure storage area. Because common carriers (Federal Express, Purolator Courier, etc.) will not sign chain-of-custody forms, the forms will be placed in a plastic bag and sealed inside the cooler prior to shipping.

Samples will be properly packaged for shipment and dispatched to the appropriate laboratory/laboratories for analysis. Shipping containers will be secured with strapping tape and custody seals for shipment to the laboratory. A signed, dated, custody seal (Figure 5-3) will be placed over the lid opening of the sample cooler to indicate if the cooler has been opened during shipment prior to receipt by the laboratory/laboratories.

Whenever samples are split with a source or government agency, a separate chain-of-custody is prepared for those samples and marked to indicate with whom the samples are being split. The person relinquishing the samples to the facility or agency should request the representatives signature acknowledging sample receipt.

The original chain-of-custody form will accompany each shipment and a copy will be retained by the sampler for returning to the sampling office. If the samples are sent by common carrier, a bill of lading should be used. Receipts of bills of lading will be retained as part of the permanent documentation. If sent by mail, the package will be registered with return receipt requested. Commercial carriers are not required to sign off on the custody-of-custody form as long as the forms are sealed inside the sample cooler and the custody seals remain intact.

CHAIN-OF-CUSTODY SEAL

CHAIN-OF-CUSTODY SEAL

SCALE  
N.T.S



**GERAGHTY  
& MILLER, INC.**  
*Environmental Services*

EXAMPLE: CUSTODY SEAL  
QUALITY ASSURANCE PROJECT PLAN  
VERIFICATION MONITORING PLAN  
NORTHSIDE SANITARY LANDFILL  
ZIONSVILLE, INDIANA

FIGURE

5-3

## **5.2 LABORATORY CHAIN-OF-CUSTODY PROCEDURES**

Upon receipt of the samples at the laboratory, the laboratory sample custodian will note the condition of each sample received as well as any questions or observations concerning sample integrity. The laboratory sample custodian also will maintain a sample tracking record that will follow each sample through all stages of laboratory processing. The sample tracking records will document sample removal from storage as well as the date of sample extraction or preparation, and sample analysis. These records will be used to determine compliance with handling and holding time requirements. Samples will be stored by the laboratory in their original containers in walk-in refrigerators designated by the contracted laboratory.

The specific chain-of-custody procedures used by the designated contract laboratory/laboratories, for sample receiving and log-in; sample storage; tracking during sample preparation and analysis; and storage of data will be described in their CompQAP.

## **6.0 CALIBRATION PROCEDURES AND FREQUENCY**

This section describes procedures for maintaining the accuracy of all the instruments and measuring equipment which are used for conducting field tests and laboratory analyses. These instruments and equipment should be calibrated prior to each use or scheduled on a periodic basis.

### **6.1 FIELD INSTRUMENTS/EQUIPMENT**

Instruments and equipment used to gather, generate, or measure environmental data will be calibrated at a frequency and in such a manner that accuracy and reproducibility of results are consistent with the manufacturer's specifications.

Equipment to be used during the field sampling will be examined to certify that it is operating condition. This includes checking the manufacturing's operating manual and the instructions for each instrument to ensure that all maintenance requirements are being observed. Field notes from previous sampling trips will be reviewed so that the notation on any prior equipment problems are not overlooked, and all necessary repairs to equipment have been carried out.

Calibration of field instruments utilized to conduct field analyses will be performed at the intervals specified according to the SOPs included in Table 3-3 of this QAPjP, or more frequently as conditions dictate. Field instruments will include a pH meter, thermometer, specific conductivity meter, explosimeter/oxygen meter and an OVA or Organic Vapor Photoionization Detector (PID). In the event that an internally calibrated field instrument fails to meet calibration/checkout procedures, it will be returned to the manufacturer for service.

The pH meter will be calibrated with standard buffer solutions prior to a field trip. In the field, the meter will be calibrated daily with two buffers before use. Throughout the day, calibration of the meter will be checked against the two buffer solutions. Calibration procedures and frequency will be recorded in a field log book along with the lot numbers of the buffer. General procedures for pH meter, specific conductivity meter and thermometer.

## **6.2 LABORATORY INSTRUMENTS**

### **6.2.1 Calibration Procedures & Frequency for Laboratory Analyses**

In all cases where analyses are conducted according to the USEPA Contract Laboratory Program (CLP), the calibration procedures and frequencies specified in the applicable CLP Statement of Work (SOW), OLM01.6 and ILMO1, methods will be followed. Calibration procedures and frequencies for instruments used to analyze landfill gas samples will be conducted according to the modified Compendium of Air Toxics methodologies. Specific calibration procedures and calibration frequency employed by the contracted laboratory/laboratories will be included in their CompQAP.

### **6.2.2 Organic Analyses**

Prior to calibration, the instrument(s) used for Gas Chromatograph/Mass Spectrometer (GC/MS) analyses are tuned by analysis of p-bromofluorobenzene (BFB) for volatile analyses and decafluorotriphenyl phosphine (DFTPP) for semi-volatile analyses. Once the tuning criteria for these reference compounds are met, the instrument should be initially calibrated by using a five point calibration curve. The instrument tune will be verified each 12 hours of operation.

After the tuning criteria are met, the instrument is initially calibrated using a five point calibration curve. Continuing calibration is verified as specified in the method, or at least each working day, using criteria specified by the method. The calibration standards will be USEPA or National Institute of Standards and Technology (NIST) traceable and are spiked with internal standards and surrogate compounds. The frequency of calibration and continuing calibration verification for each instrument will be performed at approved intervals as specified by the manufacturer or the analytical method (whichever is more frequent).

### **6.2.3 Metals Analysis**

Laboratory instruments used to perform metals analyses will be calibrated according to the designated contract laboratory CompQAP. The Atomic Absorption Spectrophotometer (AAS) instrument is calibrated by use of a minimum of three calibration standards prepared by dilution of certified stock solutions and an analysis blank. The standards bracket the concentration range of the samples. Inductively Coupled Plasma Emission Spectrophotometer (ICP) instruments are calibrated by use of a two point calibration using an analysis blank and one calibration standard prepared by dilution of certified stock solutions. A continuing calibration standard, prepared from a different stock solution than that used for preparation of the calibration standards, is prepared and analyzed after each ten samples. For the ICP, linearity near the quantitation limit will be verified with a standard prepared at a concentration of two to five times the quantitation limit. Calibration standards will contain acids at the same concentration as the digestates.



## **7.0 ANALYTICAL PROCEDURES**

The analytical procedures used during the implementation of the Verification Monitoring Plan are listed in Table 1-1. Analysis of the leachate/groundwater collected by the contractor will be performed by designated contract laboratory in accordance with protocols and QA procedures established by USEPA 3/90 CLP SOW (OLM01.6 and ILM01) methodologies. Analysis of the landfill gas samples collected by the contractor will be performed by designated contract laboratory in accordance with protocols and QA procedures established by the Compendium of Air Toxics Methodologies.

### **7.1 LABORATORY ANALYTICAL PROTOCOLS**

#### **7.1.1 Leachate/groundwater Samples**

USEPA CLP methods will be used as the basis for all analyses. The laboratory/laboratories will follow methods detailed in the USEPA 3/90 CLP SOW protocols for organic (OLM01.6) and inorganic (ILM01) analyses for the leachate/groundwater sample analyses performed during this investigation. Sample preparation and cleanup will be employed as required according to the USEPA 3/90 CLP SOW, OLM01.6 protocols. Gel Permeation Column (GPC) cleanup will be performed for BNA analyses as necessary to permit compound resolution and quantitation. The specific organic and inorganic target compound list that will be analyzed by the laboratory/laboratories following these method protocols are included in Table 3-1.

#### **7.1.2 Landfill Gas**

USEPA published methods will be used as the basis for all analyses. For the analysis of landfill gas samples for the constituents listed in Table 3-2, the laboratory will follow methods detailed in the Compendium of Air Toxics Methodologies.

## **7.2 FIELD SCREENING ANALYTICAL PROTOCOLS**

The procedures for field measurement of pH, specific conductivity, temperature, total organic vapors, and methane will be described in the respective SOP of the designated contract laboratory CompQAP.

## **8.0 INTERNAL QUALITY CONTROL CHECKS**

Internal quality control (QC) checks are those procedures used during all phases of the work that are designed to control the individual processes involved in data generating activities. Internal QC checks of sampling procedures and laboratory analyses will be conducted periodically throughout the investigation at pre-determined intervals as applicable to all parameters of interest and all matrices sampled. The following discussion describes the required QC checks to be performed for both the field and laboratory activities .

### **8.1 FIELD QUALITY CONTROL SAMPLES**

Field quality control samples are necessary to monitor both field and laboratory performance. Field QC samples provide a means of checking the validity of the sample results. Internal QC checks for general field sampling precision and accuracy will consist of the preparation and submittal of equipment blanks, field blanks, trip (travel) blanks, and field replicates (field duplicates), in accordance with the applicable procedures and frequencies described in Table 1-1. These field QC checks will consist of the preparation and submittal of equipment blanks, and field duplicates for analysis of all parameters of interest for each matrix.

#### **8.1.1 Blank Samples**

The effectiveness of personnel sample handling techniques may be monitored by submitting preserved equipment rinsate blank samples for laboratory analysis. These blank samples will be prepared by field personnel and treated in the same manner as actual samples. Internal QC checks consisting of equipment rinsate, field preservation, and trip blanks will be prepared and analyzed as described below.

#### **8.1.1.1 Equipment Rinsate Blanks**

Equipment rinsate blanks will be collected as a check on the efficiency of the cleaning procedures for the sampling equipment. Equipment blanks are collected by placing laboratory-grade (organic-free/deionized, distilled, [ASTM Type II]) water in contact with the field sampling apparatus (coring device, spoons, bowls, bailer, pump tubing, etc) after it has been decontaminated, collecting that water in appropriate sample containers and preserving in the same manner as the field samples. Equipment blanks are analyzed along with the samples for the parameters/analytes of interest. Equipment blanks will be prepared at a frequency of 1 per day (when sampling equipment is decontaminated in the field) per 20 samples per sample matrix. If equipment is not decontaminated in the field only 1 equipment blank per day per sample matrix will be required. The expected number of equipment rinsate blank samples to be collected are listed in Table 1-1. Additionally, landfill gas blanks prepared with zero grade air will be collected in accordance with the defined method specifications. Appropriate sample containers for each analyte group must be used. These blanks will be appropriately labeled and documented in field records. These blanks will be stored, transported, and analyzed with the samples.

#### **8.1.1.2 Field Preservation Blanks**

Field preservation blanks are blanks of laboratory-grade (organic-free/deionized, distilled, or ASTM Type II) water that are prepared on-site by filling appropriate sample containers with the water, adding appropriate preservatives, sealing the containers, and completing the appropriate documentation. The same water source as used for the equipment decontamination and equipment blanks should be used for field blanks. These blanks, if used, should be prepared in the beginning of the sampling day and remain stored with collected samples throughout the sampling event. Field blanks are treated, stored, transported and analyzed in the same manner as the sample group for which it was intended. Field blanks are analyzed along with the samples for the parameters/analytes of

interest. Field blanks will be prepared at a frequency of 1 per day (when sampling equipment is decontaminated in the field) per 20 samples per sample matrix.

#### **8.1.1.3 Trip Blanks**

Trip blanks consist of a pair of 40-ml volatile organic compound (VOC) vials with Teflon™ lined septums, filled in the laboratory (or organization providing the sample containers) with laboratory-grade (organic-free/deionized, or distilled) water that travels unopened with the VOC sample bottles to the sampling site and is returned with the VOC samples in the same shipping cooler to the laboratory. Trip blanks are analyzed along with the samples for VOCs of interest. Trip blanks remain unopened for the entire trip. Proper labeling and documentation will be completed for all trip blanks. One trip blank will be collected per day per cooler of VOC samples.

#### **8.1.2 Sampling Quality Control Check Samples**

The precision of field sample collecting techniques will be monitored by submitting various types of field QC check samples. These samples also may serve as rough estimates of laboratory analytical precision based on sample homogeneity. Field QC check samples that will be employed by the contractor will be field duplicate samples. Duplicate samples are defined as: "those samples collected simultaneously from the same source under identical conditions into separate but identical containers, preserved with the same preservative, and stored, transported and analyzed in the same manner." This definition means that each sample aliquot removed from a sample source (leachate/groundwater and landfill gas) will be divided equally into separate but identical sample containers. This process will be repeated until each sample container is properly filled thus resulting in two identical, duplicate samples. Each sample will then be identically preserved, stored, transported and analyzed.

Field duplicates may be analyzed by the same laboratory or by two different laboratories. Typically, when analyzed by the same laboratory, the field duplicate sample is given a different identification number to disguise it from the laboratory. When submitted to two or more different laboratories, the duplicate samples may be given the same identification. Field duplicate samples analyzed by the same laboratory allow the sampler to evaluate the inter-laboratory analytical precision. Field duplicate samples analyzed by different laboratories allow the sampler to evaluate or compare the intra-laboratory precision for situations requiring third party oversight.

For this project, field duplicates will be collected at a frequency of 1 duplicate per 20 samples per sample matrix. The number of duplicate samples to be collected is listed in Table 1-1.

## **8.2 FIELD MEASUREMENT**

Internal quality control checks to assess sampling procedures will include a QC check on field measurements for pH, conductivity, temperature, explosimeter/oxygen, and total organic vapor/methane. These measurements are limited to checking the reproducibility of the measurement by obtaining multiple readings on a single sample or standard and by calibration checks of the instruments.

## **8.3 LABORATORY ANALYSIS**

Internal laboratory control procedures used by the contracted laboratories are specified in the EPA 3/90 CLP SOW for each organic (OLM01.6) and inorganic (ILM01) method to be performed. The laboratories will demonstrate the ability to produce acceptable results using the methods requested. The data will be evaluated by the laboratories based on the method criteria as appropriate for organic and inorganic chemical analyses.

### **8.3.1 Laboratory QA Programs**

The contracted laboratories have written CompQAPs which provides rules and guidelines to ensure the reliability and validity of work conducted at the laboratory. Compliance with the CompQAP is coordinated and monitored by the laboratory QA Officer, who acts independently of the operating departments. The objectives of the laboratory QA Programs are to:

- o Ensure that all procedures are documented, including any changes in administrative and/or technical procedures.
- o Ensure that all analytical procedures are conducted according to sound scientific principles and have been validated.
- o Monitor the performance of the laboratory by a systematic inspection program and provide for corrective action as necessary.
- o Collaborate with other laboratories in establishing quality levels, as appropriate.
- o Ensure that all data are properly recorded and archived.

All laboratory procedures are documented in writing as either SOPs or Method Procedures (MP) which are edited and controlled by the QA Officer. Internal quality control procedures for analytical services will be conducted by the contracted laboratory/laboratories in accordance with their SOPs and the individual method requirements.

### **8.3.2 Analytical Quality Control Checks**

- This document specifies the general scope of services to be performed by the laboratory, the analytical QA/QC requirements to be met, and the QC data to be developed and reported.

The internal laboratory control checks specified for the laboratory are in accordance with the EPA precision and accuracy criteria specified for selected analytical methods. The laboratories are required to demonstrate their ability to produce acceptable results using the methods selected by the generation of acceptable QC data. Analytical data is evaluated by the laboratories prior to submittal based on internal reviews of the QC data. Quality control check specifications include the types of checks required (sample spikes, surrogate spikes, reference samples, controls, blanks), the frequency of each QC check, the compounds to be used for sample spikes and surrogate spikes, and the quality control acceptance criteria for these checks.

The contracted laboratory will document, in each data package provided, that both initial and ongoing instrument and analytical QC functions have been met. Any samples analyzed in non-conformance with the QC criteria will be reanalyzed by the laboratory, if sufficient sample volume is available. It is expected that sufficient volume of samples will be collected for reanalyses.

A summary of the type of QC information (as appropriate for organic and inorganic chemical analyses) that will be used as internal checks of precision and accuracy by the laboratory and by the contractor are described but not limited to the items listed below.

- Calibration curves (Organics and Inorganics)
- Continuing Calibration verification (Organics and Inorganics)
- Blanks (Organics and Inorganics)
- Laboratory Control Samples (LCS) - Inorganics only



- Reagent Water Blank Spikes (RWS) - Organics and Inorganics
- Matrix Spikes (MS) - Organics and Inorganics
- Surrogate Spikes (Organics only)
- Duplicate Analyses
  - o Reagent Water Spike Duplicates (Organics and Inorganics)
  - o Matrix Spike Duplicates (Organics only)
  - o Laboratory Duplicates (Inorganics only)
- Calculation of Relative Percent Differences for Duplicate Analyses
- Calculation of Percent Recoveries for Control Samples (LCS, MS, RWS and Surrogates)
- Internal Standards Performance (Organics)
- Linearity and Interference Check Standards (Inorganics only)
- Adequacy of detection limits
- Holding time

#### **8.4 METHOD DETECTION LIMITS FOR LABORATORIES**

Specific procedures are to be followed by laboratory in determining method detection limits. These procedures will be followed in all cases. Required detection limits will be communicated to the subcontractor laboratory/laboratories prior to beginning sampling.

#### **8.5 ANALYTICAL DATA QUALITY**

Analytical quality control checks are performed in the laboratory in an identical manner. These procedures are based upon USEPA analytical methods guidance and generally accepted standards of good laboratory practice. The principle criteria for validating data quality is the continuous monitoring of acceptable analytical accuracy, precision, and overall method performance through systematic analysis of quality control samples. The designated contract laboratory/laboratories will conduct both initial and continuous analytical method performance evaluations to ensure that all generated analytical data meet acceptable quality control method performance criteria established by the USEPA and the laboratory. Each analytical method commonly used in the laboratory utilizes specific quality control procedures to continually monitor acceptable analytical method

accuracy and precision. These method quality control procedures primarily involve the mandatory systematic insertion of quality control samples into 10% of all laboratory analyses, in addition to strict adherence to instrumental performance and calibration specifications. These specific quality control procedures are thoroughly detailed in the analytical methods Standard Operating Procedures and are based upon USEPA methods guidance.

#### **8.5.1 Initial Demonstration of Method Proficiency**

Prior to the introduction of any new method, the laboratory conducts a demonstration of method proficiency to show the ability to achieve acceptable method accuracy and precision. This initial demonstration of method proficiency is summarized below.

A minimum of four (4) spiked samples are prepared using a representative sample matrix. These samples are spiked such that the parameter concentration(s) are within the working range of the method and at least two (2) times greater than the method's background level.

The matrix spike samples are analyzed in accordance with the method. The average percent recovery (R) and the standard deviation of the percent recoveries (s) is calculated from the analytical results. The laboratory values of R are compared to the published EPA method performance value of average recovery. Unacceptable values require the laboratory to review potential analytical problems and repeat the initial demonstration of method proficiency until acceptable values are obtained or the limitations of the method are demonstrated. These results are maintained in the Quality Control Department.

### **8.5.2 Matrix Spike/Spike Duplicate Evaluations**

Mandatory matrix spike/spike duplicate samples are analyzed at a frequency of 5% in order to maintain continuous surveillance of acceptable method performance. Approximately fifty percent (50%) of all quality control samples are matrix spike samples. Percent recovery determinations (R) from these results are monitored to provide a measure of the overall accuracy and precision of the method in addition to determining extraction efficiencies and sample matrix effects.

Laboratory quality control charts are constructed from this data in order to monitor and compare actual laboratory quality control data with acceptable published USEPA or laboratory method performance criteria.

### **8.5.3 Method Blank Evaluations**

Each laboratory prepares and analyzes daily method blanks for all applicable parameters to evaluate analytical system interferences and background contamination levels. Method blank analyses include all components (glassware, chemical reagents environment etc.) of actual routine method analyses substituting reagent water or another applicable clean matrix for the actual sample. Approximately twenty-five percent (25%) of all quality control samples are method blanks. Analyses of method blanks provides a safeguard against interfering and/or contaminated reagents, glassware, and laboratory environments. The results of all method blank analyses are recorded in the laboratory computer data management system. Unfavorable method blank performance renders associated data suspect and requires corrective action.

#### **8.5.4 Surrogate Spike Recovery Evaluation**

- Each laboratory conducts surrogate spike recovery evaluations to ensure acceptable method performance. Surrogate spikes consisting of method compound analogues are added to all GC/MS analyses, volatile analyses, and BNA analyses to evaluate acceptable method performance. Surrogate spike recoveries must compare favorably to published USEPA method or statistically derived laboratory performance limits in order for an analysis to be acceptable. Unfavorable surrogate spike recoveries render associated data suspect and require corrective actions.

#### **8.5.5 Check Sample Evaluations**

Each laboratory prepares and analyzes check samples on each group of samples on a daily basis for all applicable parameters. The purpose of check samples is to continuously evaluate method performance. Approximately twenty-five percent (25%) of all quality control samples are check samples. Percent recovery determinations from these check samples are monitored to provide a continuous measure of each method's accuracy. Laboratory quality control charts are constructed from this data in order to monitor and compare actual check sample data with laboratory method performance criteria.

#### **8.5.6 Corrective Measures**

Corrective action for matrix spikes/spike duplicates, surrogates, and check samples are based on the control limits for each parameter. The control limits are established by the laboratory on a semiannual basis.

## **9.0 DATA REDUCTION, VALIDATION, AND REPORTING**

### **9.1 DATA REDUCTION**

As analyses are completed, the digital electronic, or physical data will be reduced and converted into readily usable form in measurement units appropriate for the analysis. All measurements will be reported in appropriate significant figures.

#### **9.1.1 Field Measurements and Sample Collection**

Raw data from field measurements and sample collection activities will be appropriately recorded in the field log book. If the data are to be used in the project reports, they will be reduced and the method of reduction will be documented in the report.

#### **9.1.2 Laboratory Services**

The samples collected at NSL during the verification monitoring program will be sent to the designated contract laboratory for analysis. Data reduction, evaluation, and reporting for these samples will be performed according to the procedures specified in each laboratory's CompQAP. Reduced data will be submitted to the contractor for review and data validation.

### **9.2 DATA VALIDATION**

Data validation is a systematic process for reviewing a body of assembled analytical results against a set of criteria to provide assurance that the data is adequate for its intended use. The data validation procedures employed will include an evaluation of the field data package and an evaluation of the laboratory analytical data package. The data acceptance criteria has been stated in Section 3.0 - QA Objectives for Measurement Data. Validation

of volatile and semi-volatile organics will be accomplished by comparing the contents of the analytical data packages and QA/QC results to the requirements contained in the National Functional Guidelines for Organic VOC/Semi-VOC Data Review - USEPA, 12/90, Revised 6/91. Validation of metals and inorganics analyses will be in accordance with the requirements specified in the Laboratory Data Validation Functional Guidelines for Evaluating Inorganic Analyses - USEPA, July 1988 plus any modifications contained in the QA/QC Section of the USEPA 3/90 CLP SOW (ILM01.01) for inorganics.

Raw data such as GC/MS Total Ion Current (TIC) chromatograms, GC chromatograms, and mass spectra, ICAP and FAA data reports, and data station printouts will be examined during the validation procedure to ensure that reported results are accurate.

The data validation procedures employed for this project will include an evaluation of the field data package and an evaluation of the laboratory analytical data package. The data validation checklists will be used as guides in evaluating sample collection, field records, and analytical performance. These checklists will aid in identifying valid data and classifying the data into one of three use categories: unusable data, qualitative data (class A), and quantitative data (class B).

#### **9.2.1 Validation of the Field Data Package**

The field data package will be reviewed by the contractor, project QA Officer, or his designee for completeness and accuracy. The field data package includes all of the field records and measurements developed by the sampling team personnel. Failure in any of these areas may result in the data being invalidated. The field data package validation procedure will include but not be limited to:

- \* A review of field data contained in water and air sampling logs for accuracy and completeness;
- \* A verification that samples, field replicates, field duplicates, equipment blanks, field blanks (if collected), and trip blanks, were properly prepared, preserved, identified and analyzed (field analyses);
- \* A check on field analyses for equipment calibration, instrument condition, and that all QC check sample results for field measurements of pH, specific conductivity, and temperatures were within established control limits, and
- \* A review of chain-of-custody forms for proper completion, signatures of field personnel and the laboratory sample custodian and dates.

#### **9.2.2 Validation of the Laboratory Data Package**

All laboratories employed during this monitoring program will be required to submit data that are supported by sufficient QA backup information and data to enable data reviewers to conclusively evaluate the quality of the data.

After validation of the field data package, validation of the analytical data package pertaining to each appropriate matrix (leachate/groundwater and landfill gas) will be performed by the project QA Officer or his designee. The Project QA Officer will review and validate all laboratory data packages developed for the project. Besides spot-checks of raw data, the data documentation and validation process may include editing and reviewing laboratory sample logbooks, worksheets, method logbooks, instrumental chromatograph printouts, strip charts and readouts, instrument logbooks and service records, calibration logbooks, and data files.

The Project QA Officer will conduct a systematic review of the data for compliance with the established QC criteria for the USEPA 3/90 CLP SOW modified as appropriate by the requirements specified in the USEPA Laboratory Data Validation Functional

**Guidelines for Organics and Inorganics Analyses.** An evaluation of data accuracy, precision, sensitivity and completeness, using the duplicate and laboratory control sample data will be performed and presented in the final report. The validation steps will be performed by applying where appropriate the USEPA Laboratory Data Validation Functional Guidelines For Evaluating Organics and Inorganics Analyses, and/or the precision and accuracy criteria specified for the method.

The analytical data package validation procedure may include but is not be limited to the following:

- \* Comparison of the data package deliverables to ensure completeness in the analytical data package and compliance with the contract;
- \* Comparison of sampling dates, sample extraction dates, and analysis dates to check that samples were extracted and/or analyzed within proper holding times;
- \* Review of the analytical methods and required detection limits to verify that they agree with the site specific QAPP, the Laboratory Task Order and the contract;
- \* Review of field and laboratory blanks to evaluate possible contamination sources. The preparation techniques and frequencies, and the analytical results (if appropriate) will be considered. All blanks will be evaluated in accordance with the EPA Functional Guidelines for Validation of laboratory Data;
- \* Review of field duplicates/replicates to check the precision of chemical analyses and field sample collection techniques. Field replicates and laboratory duplicates for water matrices, if available will be reviewed. The results must be within the EPA specified requirements for each method's precision; in the absence of this information, inorganic parameter duplicates must have a relative percent difference (RPD) of 20 percent if the analyte value is greater than five times the detection limit; if the value is less than five times the detection limit, the duplicates must have an RPD no greater than the detection limit;



- \* Comparison of surrogate spike results to applicable control limits specified for the method; and
- \* Review of matrix spike recoveries to evaluate the presence of matrix interferences that may be affecting recovery of a particular analyte.

The data review will identify any out-of-control data points and data omissions and interact with the laboratory to correct data deficiencies. Decisions to repeat sample collection and analyses may be made by the Project Manager based on the extent of the deficiencies and their importance in the overall context of the project.

### **9.3 DATA REPORTING**

Because the analytical quality assurance requirements for all reporting levels for laboratory analyses are essentially identical, all of the data generated at any level may potentially be classified as quantitative. If increased defensibility of laboratory report data is required additional documentation of analytical QA data will be available upon request to the laboratory to support validation conclusions and data usability determinations.

The contractor will conduct a systematic review of the data for compliance with the established QC criteria based on the results provided by the laboratory. An evaluation of data accuracy, precision, sensitivity and completeness of all analytical results will be performed and summarized in the validation report.

All data generated for the Verification Monitoring Plan will be computerized in a format organized to facilitate data review and evaluation. The computerized data set will include the data flags in accordance with the "Laboratory Data Validation Functional Guidelines for Evaluating Organic Analyses," and "Inorganic Analyses," as well as additional comments of the Data Reviewer.

The laboratory-provided data flags will include such items as estimated concentration below required detection limit, and concentration of chemicals also found in blanks. The data reviewer comments will indicate that the data are: i) usable as a quantitative concentration, ii) usable with caution as an estimated concentration, or iii) unusable due to out-of-control QC results.

## **10.0 PERFORMANCE AND SYSTEM AUDITS**

Performance and system audits of both field and laboratory activities will be conducted to verify that sampling and analysis are performed in accordance with the procedures established in the VMP and QAPjP. The audits of field and laboratory activities include two separate independent parts: Internal and External audits.

### **10.1 FIELD AUDITS**

Internal audits of field activities (sampling and measurements) will be conducted by the contractor Project Manager, QA Officer, and/or Field Team Leader. The audits will include examination of field sampling records, field instrument operating records, sample collection, handling and packaging in compliance with the established procedures, maintenance of QA procedures, chain of custody, etc. The audits also will involve review of field measurement records, instrumentation calibration records, and sample documentation. These audits will occur at the onset of the project to verify that all established procedures are followed. Follow-up audits will be conducted to correct deficiencies, and to verify that QA procedures are maintained throughout the investigation. External audits may be conducted by USEPA Region V or the IDEM.

### **10.2 LABORATORY AUDITS**

Laboratory systems audit are conducted to assure that system and operational capability is maintained and test methodology and quality control measures for the project are being followed as specified in the laboratory written SOPs and CompQAPs. The Systems Audit Checklist used by the USEPA CLP forms the procedural basis for conducting these audits.

The designated contract laboratory/laboratories should participate in and are approved to perform work under various USEPA and other federal or state agency programs that require recurring on-site audits. In addition, laboratory initiated performance and system audits are performed by the designated contract laboratory as described in their specific CompQAP.

## **11.0 PREVENTATIVE MAINTENANCE PROCEDURES**

### **11.1 FIELD EQUIPMENT/INSTRUMENTS**

The field equipment for this project includes thermometers, pH meter, conductivity meter, explosimeter/oxygen meter, and OVA. Specific preventative maintenance procedures to be followed for field equipment are those recommended by the manufacturer. Field instruments will be checked and calibrated in the office before they are shipped or carried to the field. These instruments will be checked and calibrated daily before use. Calibration checks will be performed after every 10 samples or twice each day and will be documented in the Field Log.

Backup instruments and equipment should be available within one-day shipment to avoid delays in the field schedule. A listing of the field testing equipment that may require preventive maintenance and their frequency for routine service is presented in Tables 11-1 and 11-2.

### **11.2 LABORATORY INSTRUMENTS**

As part of their QA/QC Program, a routine preventative maintenance program is conducted by the designated contract laboratory/laboratories to minimize the occurrence of instrument failure and other system malfunctions. All laboratory instruments are maintained in accordance with manufacturer's specifications and the requirements of the specific method employed. This maintenance is carried out on a regular, scheduled basis, and is documented in the laboratory instrument service logbook for each instrument. The specific protocols used by each of the contracted laboratories are described in their laboratory CompQAP.

**Table 11-1. List of Field Testing Equipment; QAPjP for Verification Monitoring Plans; Northside Sanitary Landfill; Zionsville, Indiana.**

Item	Manufacturer and I.D. No.	Model Type	Location	Preventive Maintenance
Conductivity Meter	Beckman/90415 or equivalent	RB-5-338	Equip Rm	See Table 11-2
pH Meter	Corning/5055 or equivalent	Field Type	Equip Rm	
Thermometers	---	C° Mercury	Field Thermometer	
Explosimeter/Oxygen Meter	Gas Tech	1214S	Equip Rm	
Organic Vapor Analyzer	Foxboro	OVA 1286C	Equip Rm	

Table 11-2. Preventive Maintenance and Calibration Frequency for Field Equipment;  
QAPjP for Verification Monitoring Plan; Northside Sanitary Landfill;  
Zionsville, Indiana.

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Conductivity Meters

- a. Each Use: Meter probes are cleaned before and after each use with distilled/deionized water.

Before each use (once daily) the instruments are checked with a commercial conductivity standard for proper calibration.

The battery is checked for proper charge.

- b. Quarterly: The instrument is inspected on a quarterly basis, whether used during the quarter or not.

The inspection consists of a general examination of the electrical system (including batteries) and a calibration check.

Instruments not functioning properly are shipped to the manufacturer for repair and calibration.

pH Meters

- a. Each use: Before each use (daily), the probe should be checked for cracks in the electrode bulb and complete filling with electrolyte solution.

At the beginning of any sampling day, the pH meter must be calibrated using standard pH buffers.

The battery is checked for proper charge.

Following each use, the probe is rinsed with deionized water. The probe cap is filled with electrolyte solution and placed on the probe tip. Excess electrolyte is rinsed off and the probe dried with a paper towel. The instrument is then placed in its carrying case.

Table 11-2. Preventive Maintenance and Calibration Frequency for Field Equipment; QAPjP for Verification Monitoring Plan; Northside Sanitary Landfill; Zionsville, Indiana.

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- b. Quarterly: The instrument is inspected on a quarterly basis whether or not it has been used.
- The inspection consists of a general examination of the probe, wire, electrical system (battery check) and a calibration check.
- Any malfunctioning equipment is returned to the manufacturer for repair and recalibration.

#### Thermometers

- a. Each use: Before each use, thermometers are visually checked for cracks and mercury separation.
- After use, thermometers are rinsed with deionized or distilled water and replaced in their protective case to prevent breakage.
- b. Monthly: Thermometers are visually inspected as described above, whether used or not. They are checked against an NBS certified thermometer for accuracy.

#### Organic Vapor Analyzer

- a. Each use: The instrument calibration will be checked in the field with a secondary standard (isobutylene) prior to any analysis and at the end of the day. Gas flows are checked periodically.
- If the instrument response deviates by more than 10 percent from the known value, the instrument is removed from the field and recalibrated against the primary standard (methane).
- b. Monthly: The instrument calibration is checked against a primary standard (methane). Recalibration is performed if



Table 11-2. Preventive Maintenance and Calibration Frequency for Field Equipment;  
QAPjP for Verification Monitoring Plan; Northside Sanitary Landfill;  
Zionsville, Indiana.

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required. Electrical and gas connections will be checked and cleaned.

Explosimeter/Oxygen Meter

- a. Each use: The instrument calibration will be checked in the field with a secondary standard prior to any monitoring and checked periodically throughout the day.
- If the instrument response deviates by more than 10 percent from the known value, the instrument is removed from the field and recalibrated against the standard. Additionally, silicones, halides, tetraethyl lead, and oxygen enriched atmospheres may damage the filament.
- b. Monthly: The instrument calibration is checked against a primary standard. Recalibration is performed if required. Electrical and gas connections will be checked and cleaned.

## **12.0 SPECIFIC ROUTINE PROCEDURES TO ASSESS DATA PRECISION, ACCURACY, AND COMPLETENESS**

### **12.1 FIELD MEASUREMENTS**

Field data will be assessed by the Project or Field Manager for each task. The site Project or Field Manager will review the field results for compliance with the established QC criteria that are specified in the QAPjP and VMP. Accuracy of the field measurements will be assessed using daily instrument calibration, calibration check, and analysis of blanks. Precision will be assessed on the basis of reproducibility by multiple reading of a single sample. Data completeness will be calculated using the following equation:

$$\text{Completeness} = \frac{\text{Valid Data Obtained}}{\text{Total Data Planned}} \times 100$$

### **12.2 LABORATORY DATA**

Laboratory results will be assessed for compliance with required precision, accuracy, completeness and sensitivity as follows:

#### **12.2.1 Precision**

Precision of laboratory analysis will be assessed by comparing the analytical results between matrix spike/matrix spike duplicate (MS/MSD) for organic analysis, and laboratory duplicate analyses for inorganic analysis. The relative percent difference (%RPD) will be calculated for each pair of duplicate analysis using the following equation:

$$\%RPD = \frac{S - D}{(S + D)/2} \times 100$$

Where:

S = First sample value (original or MS value); and

D = Second sample value (duplicate or MSD value)

### 12.2.2 Accuracy

Accuracy of laboratory results will be assessed for compliance with the established QC criteria using the analytical results of method blanks, reagent/preparation blank, matrix spike/matrix spike duplicate samples, field blank, and bottle blanks. The percent recovery (%R) of matrix spike samples will be calculated using the following equation:

$$\%R = \frac{A - B}{C} \times 100$$

Where:

A = The analyte concentration determined experimentally from the spiked sample;

B = The background level determined by a separate analysis of the unspiked sample and;

C = The amount of the spike added.

### **12.2.3 Completeness**

The data completeness of laboratory analyses results will be assessed for compliance with the amount of data required for decision making. The completeness is calculated using the equation presented in Section 12.1.

### **12.2.4 Sensitivity**

The achievement of method detection limits depend on instrumental sensitivity and matrix effects. Therefore it is important to monitor the instrumental sensitivity to ensure the data quality through constant instrument performance. The instrumental sensitivity will be monitored through the analysis of method blank, calibration check sample, and laboratory control samples. Minimum requirements for analytical sensitivity are discussed in Tables 3-1 and 3-2.

### **13.0 CORRECTIVE ACTIONS**

Corrective actions may be required for two classes of problems: analytical and equipment problems and noncompliance problems. Analytical and equipment problems may occur during sampling and sample handling, sample preparation, laboratory analysis, and data review. For noncompliance problems, a formal corrective action program will be determined and implemented at the time the problem is identified. The person who identifies the problem is responsible for notifying the contractor QA Officer or the Project Manager. If the problem is analytical in nature or equipment related, information on these problems will be promptly communicated to the contractor QA Officer. Implementation of corrective action will be confirmed in writing through the same channels. Any nonconformance with the established quality control procedures in the QAPjP or VMP will be identified and corrected in accordance with the QAPjP. The contractor QA Officer will issue a Nonconformance Report for each nonconformance condition.

Corrective actions will be implemented and documented in the field record book. No staff member will initiate corrective action without prior communication of findings through the proper channels. If corrective actions are insufficient, work may be stopped by stop-work order by the contractor Project Manager or the contractor Project Officer.

Laboratory corrective actions for out-of-control events will be specified in the designated contract laboratory's CompQAP. In these instances the procedure requires that the analysis be re-performed. Data that does not meet control limit criteria, will be evaluated and flagged with applicable qualifier codes that reflect the data validity and usability.

### **13.1 SAMPLE COLLECTION/FIELD MEASUREMENTS**

Technical staff and project personnel will be responsible for reporting all suspected technical or QA nonconformances or suspected deficiencies of any activity or issued document by reporting the situation to the Project Manager or designee. This manager will be responsible for assessing the suspected problems in consultation with the Project Officer and QA Officer, and making a decision based on the potential for the situation to impact the quality of the data. If it is determined that the situation warrants a reportable nonconformance requiring corrective action, then a nonconformance report will be initiated by the Project Manager or designee. The QA Officer will be responsible for ensuring that corrective action for nonconformances are initiated. If appropriate, the Project Manager will ensure that no additional work that is dependent on the nonconforming activity is performed until the corrective actions are completed.

The contracted Project Manager for the NSL site is responsible for the controlling, tracking, and implementation of the identified changes in the field program. Reports on all changes will be distributed to all affected parties.

### **13.2 LABORATORY ANALYSES**

Specific corrective action procedures used by the designated contract laboratory/laboratories are described in the respective CompQAPs. Additionally, any analysis not conforming to the control limits established for this investigation for precision, accuracy, detection limit, or linearity will be halted until the problem is identified and corrected. Laboratory batch sheets and control charts will document data evaluations and will contain all information necessary for assessment of the data quality, including: (1) information regarding indices of sensitivity, (2) precision, (3) detection limit, and (4) accuracy achieved during that run or batch.

For out-of-control incidents, it is essential to document the nature of the incident and the corrective actions taken to set the system back in control. A corrective action report, to be signed by the laboratory director and the laboratory quality assurance officer, should be prepared and reported in the narrative summary of the laboratory report. The following topics should be discussed:

- 1) Where did the out-of-control incident occur (laboratory name, address, telephone number, section name)?
- 2) When did the incident occur and when was it corrected?
- 3) Who discovered the out-of-control incident, verified the incident, and corrected the problem?
- 4) What was the name of the test?
- 5) What was the disposition of the test or control and/or instrument?
- 6) What was the nature of the corrective action?
- 7) What will be done to prevent the reoccurrence of the problem?
- 8) Why did the incident happen (if scientific explanation is available)?

A copy of the subject control charts and other data describing the out-of-control conditions should be included in the corrective action report. All out-of-control incident documentation and copies of the corrective action reports should be (1) placed in the laboratory archive record for the sample(s) in question and, (2) placed in the laboratory QA officers file of incidents documentation.

Any corrective actions taken by the contracted laboratories will be reported to the contractor QA Officer. The laboratory will include in each data package a discussion of the problems encountered and corrective actions taken. In addition, the laboratories will maintain a file for review that documents all corrective actions taken regardless of whether the actions performed were pertinent to the analysis of samples from contractor projects.

#### **14.0 QUALITY ASSURANCE REPORTS TO MANAGEMENT**

Each day that field activities are conducted on-site, a representative of the Field Team will complete a Daily Quality Control Report (DQCR) as shown on Figure 14-1. These reports will be transmitted to the Project QA Officer for review and inclusion into the project file. These DQCRs, along with associated field records and laboratory data, form the basis for preparing a Quality Assurance Summary.

Interim Quality Assurance Reports will be prepared during data gathering activities as necessary. These reports will cover routine quality assurance activities such as:

- 1) Results of QA audits;
- 2) Results of PE samples;
- 3) Revision of laboratory data quality objectives;
- 4) Summary of data gathering tasks; and
- 5) Summary of QA problems, field nonconformance reports, laboratory corrective action report, and corrective actions.

A Quality Assurance Summary will be prepared at the completion of the Verification Monitoring Plan. The Quality Assurance Summary will address the following:

- 1) Quality assurance activities and quality of collected data (results of data validation);
- 2) Equipment calibration and preventive maintenance activities;
- 3) Laboratory quality control data pertinent to the site;



## Daily Quality Control Report

Date: \_\_\_\_\_

A. Weather (temperature, wind speed and direction, precipitation, etc.):  
\_\_\_\_\_  
\_\_\_\_\_B. Work Performed: \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_C. Sampling Performed (location/number, sample type, etc.):  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_D. Field Analyses Performed (including instrument checks, calibration, etc.):  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_E. Problems Encountered and Corrective Actions Taken (sampling problems, alternate methods/locations, etc.):  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_F. Quality-Control Activities Initiated: \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_Signature of Reporter: \_\_\_\_\_  
Geraghty & Miller, Inc.

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SCALE  
N.T.S.

GERAGHTY  
& MILLER, INC.  
Environmental Services

DAILY QUALITY CONTROL REPORT  
QUALITY ASSURANCE PROJECT PLAN  
VERIFICATION MONITORING PLAN  
NORTHSIDE SANITARY LANDFILL  
ZIONSVILLE, INDIANA

FIGURE

14-1

- 4) Evaluation of data completeness and usability; and
- 5) Field and/or laboratory QA problems and implemented corrective actions.

All quality assurance documentation and reports will be available for review by USEPA Region V and the IDEM.

QAP\NSL\DRAFT\VMP-QAP.594

**APPENDIX G**

**VERIFICATION MONITORING PLAN**

**VERIFICATION MONITORING PLAN  
Northside Sanitary Landfill  
Zionsville, Indiana**

**Prepared for:**

**NSL TRUSTS**

**May 1994**

**Prepared By:**

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- 3-1 NSL Target Constituent List for Landfill Gas Samples; QAPjP for Supplemental Investigations; Northside Sanitary Landfill; Zionsville, Indiana.
- 5-1 Sample Container, Preservative, and Holding Time Specifications.
- 6-1 Chemicals Listed in the Hazardous Materials Table (40 CFR 172.101) Used for Preserving Samples.

### **FIGURES**

Figure 1 - Verification Monitoring Locations

### **ATTACHMENTS**

- 1. Sample Preservation Procedures for Cyanide Samples When Sulfide is Present.
- 2. Standard Cleaning Procedures.

### **APPENDICES**

- A. Quality Assurance Project Plan

## **1.0 INTRODUCTION**

The Verification Monitoring Plan conforms with the requirements of 40 CFR 265.117 and addresses the water-quality monitoring activities to be performed during post-installation operation and maintenance after completion of the initial Remedial Action construction and acceptance. These activities, in conjunction with the activities described in the Operation and Maintenance Plan (Appendix F), are designed to protect the integrity of the completed closure, monitor the performance of the individual components of the remedy, and provide the basis for final acceptance of the complete remedy and termination of site activities. This plan only addresses water-quality and analytical methodologies to be followed throughout the monitoring program.

Design modifications during the RD process have resulted in very selective analytical monitoring needs included within this plan. The most significant design modification which effects this program is the utilization of a transfer station and tanker hauling program to dispose of collected leachate/ground water, rather than constructing the conveyance pipeline. This change eliminates the need to frequently monitor the water-quality being collected before pumping to the sewer system. While monitoring of the collected water-quality is still necessary, it is now only required to monitor the change in water-quality with time to verify the remedy is meeting remediation standards. Sampling will also occur as frequently as required by the TSD facility accepting the collected liquids.

Consequently, this Verification Monitoring Plan addresses two areas; (1) monitoring the water-quality of the collected leachate/ground-water at the transfer station, and (2) monitoring upgradient and downgradient ground-water quality. This plan has incorporated, as Appendix A, the Quality Assurance Project Plan (QAPP) for the proposed activities.

## **2.0 REMEDIATION STANDARDS FOR GROUND WATER AND LEACHATE**

As presented in the Statement of Work (SOW), remediation standards have been established and are included in the RD/RA Consent Decree for the Northside Sanitary Landfill (NSL). These concentrations represent the analytical values which must be achieved in order to cease pumping of leachate and ground water at NSL.

The remediation standards included in the NSL Consent Decree and SOW are incorporated into this verification monitoring program and are listed in Table 2-1. The table includes the target constituents identified by the USEPA and ammonia and chloride proposed by the Indiana Department of Environmental Management (IDEM). As stated in the SOW, "the cleanup standards were established without accounting for possible influent/background interferences by pollutant sources other than the landfill "(SOW, page 2-24, February 1991). If influent/background concentrations exist, the remediation standards, may be adjusted to reflect actual site conditions. The NSL Trust is also concerned that some of the values presented may not be achievable due to technical impracticability either in constituent recovery or because of analytical method constraints. Section VI.D of the Consent Decree allows the Settling Defendants to petition the USEPA for a waiver in such circumstances.

Under natural conditions, Finley Creek, which is located south of NSL, serves as the discharge boundary for NSL underflow. In the Record of Decision (ROD) approved by the USEPA in September 1987, it was stated that water-quality impacts as measured by stream criteria formed the basis for site remediation standards. Under the USEPA remedial plan selected in the 1987 ROD, the environment was protected as long as discharge from its proposed on-site treatment plant met these criteria. Although no treatment plant is included in the final remedy, the primary objective of the remedy is to prevent identified constituent concentrations from exceeding the established surface-water quality criteria in Finley Creek. The remedial action, as defined in the RD, will effectively protect Finley Creek and Unnamed Ditch. The hydraulic isolation wall will prevent leachate-contaminated



shallow ground water from reaching the creeks and the cover system will eliminate the potential for surface migration of leachate via seeps and overland flow. The leachate/ground-water collection system will further enhance the remedy by removing gross constituent concentrations from the toe of the landfill. By meeting this primary objective, the remedy will be considered effective; and when it can be shown that this objective will continue to be met after the collection of leachate and ground-water is terminated, the remedy will be considered complete and active on-site operations will be concluded.

"For purposes of supplying the USEPA with the Notification of Completion of the RA referred to in Section XXIX of the Consent Decree, the Clean-up Standard for ground water may be deemed achieved for a particular contaminant upon showing, for two successive sampling events using current laboratory technology, that a cleanup standard (or other standard as may have been established pursuant to Section VI.D of the Consent Decree) has been achieved at the Facility for that constituent." (SOW, page 2-24, February 1991). This will be demonstrated based on the volume of leachate, the constituent concentrations in the leachate, or a combination of these criteria based on data from monitoring of the leachate/groundwater collection system.

"Once the remediation standards have been achieved for all 29 constituents listed in Table 2-1, ...groundwater and leachate collection terminated, ..." (SOW, pages 2-24 and 2-25, February 1991).

Since the cleanup standards establish the allowable constituent concentrations in Finley Creek, the Notification for Completion will provide sufficient data and analysis to prove that the instream water quality meet the relevant standards. The data and technical justification for completion may include additional field testing of soils and ground water, ground-water flow modeling, demonstration programs, and other methods as appropriate.

"If the remediation standards have been met for all the constituents listed in Table 2-1 other than ammonia and/or chloride, then the Settling Defendants may institute a biological testing (biomonitoring) program to determine whether termination of the leachate and ground-water collection system would have an adverse impact on Finley Creek. The design of any such biomonitoring program will be set forth in detail in the post-installation monitoring plan (as an addendum to this plan) to be developed pursuant to Section 3.1.7 (of the SOW), and subject to the approval of the USEPA, after consultation with the State, and will include, without limitation:

- o Establishing scientific procedures for the biological tests to be conducted;
- o Allowing sufficient time to pass so that ground water and leachate reach Finley Creek; and
- o Performance of the biological tests set forth pursuant to the post-installation monitoring plan.

If the above-referenced biomonitoring program is instituted, then, after it has been completed, the USEPA, after consultation with the State, shall determine whether terminating the operation of the leachate and ground-water collection system has had or may have an adverse impact on Finley Creek or may be inconsistent with Section 121 of CERCLA. If the USEPA determines that no adverse impact has or would occur, then the remediation standards for ammonia and chloride set forth in Table 2-1 will, to the extent permitted by Section 121 of CERCLA, be adjusted, consistent with the results of the biomonitoring program. If, in response to the biomonitoring program, the USEPA determines that an adverse impact may occur from adjustments of the ammonia and/or chloride remediation standard, or that adjustment of the remediation standard for ammonia and/or chloride would be inconsistent with Section 121 of CERCLA. Operation of the ground-water and leachate collection system resumed. (SOW, pages 2-27 and 2-28, February 1991).

### **3.0 MONITORING PROGRAM**

The monitoring program developed for the NSL site includes the periodic sampling and analysis of liquids collected in the leachate/ground-water recovery system and five perimeter monitoring wells and landfill gases from the gas venting system, and the associated reporting. This section describes the selection of the sampling locations, the analyses to be performed, frequency of analyses, and reporting schedule. A site map illustrating the groundwater and leachate and the landfill gas monitoring and sampling locations is provided as Figure 1. The names, addresses, and qualifications of the contractor(s) required to implement this program will be provided by the NSL Trust.

#### **3.1 GROUNDWATER AND LEACHATE MONITORING PROGRAM**

##### **3.1.1 Sampling Locations**

The liquids in the leachate/ground-water recovery system will be sampled from the sump of the collection system lift station to minimize volatilization. The objective of this sample location is to provide data on the change of leachate and ground-water quality with time. The lift station pump will be manually operated such that a minimum of one volume of the lift station sump waters will be removed. After allowing the sump to recharge, a representative sample of the collected waters will be taken.

Five monitor wells will be installed as part of the RA program. One of these wells is considered a background well and is located in the northeastern part of the site. This well location, as shown on Figure 1 and the construction drawings, will be used to document any variation between background ground-water quality and the established remediation standards. A second well will be installed in the northwestern part of the site, situated between the NSL waste area and the disposal operations currently being conducted by the site owner just north of the NSL waste area. This well location will be used to document if contaminants are migrating from the northern landfilling operations not controlled by the

NSL Trust towards the recovery system. Regional groundwater flow from the north-northeast will therefore flow through this facility towards the "northwestern monitoring well". The purpose of this well is to identify any contaminants that may be discharged from that facility and not to assess the performance of the facility. If degradation of this monitoring well begins to occur, additional wells in the vicinity of the zone between the NSL and Parcel 26 landfills may be required to assess the overall impacts to the NSL remedy. The EPA should require the operator/owner of the new landfiling operation to be responsible for any additional wells which may be needed in this area.

Three additional monitor wells will be located in a generally downgradient direction. One monitor well will be installed in the southwest corner of the site, between the hydraulic isolation wall and Finley Creek, to monitor the effectiveness of the RA system. Monitor wells will also be located near the end-points of the isolation wall to verify that the RA system is not forcing contaminated ground water around the end of the isolation wall.

The monitoring wells will be constructed of 2-inch PVC, Schedule 40 casing. A blank casing will be provided as a sedimentation trap for the well which will minimize potential problems from siltation of the well. The wells will be installed with a screen interval from 20 feet to 30 feet below land surface. The screen interval of 20-30 feet below ground surface was selected to allow for monitoring of water levels and groundwater quality of groundwater which would be passing underneath the hydraulic isolation wall. Once the isolation wall is installed, this is the only pathway for constituents to migrate from the landfill. This well depth provides a potential means to monitor hydraulic gradients and water quality during operations as well as confirm future water quality after operations are ended to document the acceptability of turning off the leachate collection system. This depth was selected so that a representative sample of ground water that may flow beneath the slurry wall could be collected. Once the isolation wall is installed, this is the only pathway for constituents to migrate from the landfill. This well depth provides a means to monitor hydraulic gradients and water quality during operations as well as confirm future water quality after operations are ended to document the acceptability of turning off the

leachate collection system. The Technical Specifications describes the complete monitoring well design. After installation, boring and well construction logs would be included as an Attachment to this plan.

### **3.1.2 Groundwater and Recovered Leachate Analyses**

The five ground-water monitor wells and recovered leachate/ground-water from the designated collection system lift station will be sampled for the NSL Target List compounds listed in Table 2-1. These constituents represent the primary constituents of concern as established by the remediation standards included in the SOW. The NSL Trust does reserve the right with USEPA approval, however, to expand upon this constituent group in the event that activities north of the NSL waste area and not under the control of the NSL Trust warrant such action.

The six defined monitoring locations will also be analyzed in the field for temperature, pH, and specific conductance during each sampling event. Water-level measurements will be taken from the five monitor wells and the lift station sump to document the ground-water gradient is towards the collection system. Measurements will be made with the pump off to obtain a more representative sample of the quality of water within the sump. A period of one hour will be allowed for stabilization of this water level prior to sampling.

The treatment facility that will receive and ultimately dispose of the leachate and/or groundwater that "contains" leachate collected in the collection system will be a RCRA TSD facility. As such, the facility will specify the requirements for influent sampling and monitoring which will be met by the NSL in order to utilize that facility. Since the receiving facility has not been identified, such monitoring cannot be precisely determined at this time.

Attachment A is the Quality Assurance Project Plan, which outlines the methodology to be followed during implementation of the sampling and analysis program.

### **3.1.3 Frequency of Analysis for Groundwater and Leachate**

The sampling frequency will be semi-annually for the first year of RA system operation. The first event will be scheduled once the RA construction activities have been completed and approved by the USEPA. Monitoring data will be analyzed at the end of the first year of sampling to identify the appropriate and adequate sampling frequency for the remainder of the verification monitoring period. At the discretion of the NSL Trust and with USEPA approval, the sampling frequency may be increased in order to document the effectiveness of the remedy and support the anticipated request to terminate the system operations.

## **3.2 LANDFILL GAS MONITORING PROGRAM**

### **3.2.1 Landfill Gas Sampling Locations**

The landfill gases in the gas venting system will be sampled from the 27 gas vents, Figure 2, located on the landfill cover system. The objective of these sample locations is to provide data on the change of landfill gas quality with time. Two types of gas vents are present the site, vertical gas vents and trench gas vents. Both vents have ground key hose cock sampling ports, allowing direct sampling.

### **3.2.2 Landfill Gas Analyses**

Two types of analyses will be performed, direct field measurements and laboratory analysis. Field measurements will include total flow rate, methane, and total VOC's. Measurements for methane and total VOCs will be performed with an explosimeter and an OVA, respectively. Laboratory analysis of landfill gases will be performed in accordance

with protocols and QA procedures established by USEPA SW-8A6 and the Compendium of Air Toxins Methodologies. The specific organic target constituent list the will be analyzed by the laboratory are included in Table 3-1.

### **3.2.3 Frequency of Analysis for Landfill Gases**

Field measurements and laboratory analyses will be performed at different frequency. Field measurements will be performed quarterly for the first two years fo RA system operation. Laboratory analyses will be performed annually for the first two years. The field measurement events will be scheduled once the RA construction activites have been completed and accepted by the USEPA. Following the first year of field measurements; the gas vents with the three highest readings will be identified and sampled for laboratory analyses. At the end of the two year period, the sampling frequencies will be reevaluated and may be decreased based on the field measurements and laboratory data.

#### **4.0 SAMPLE CUSTODY PROCEDURES**

Sample custody procedures are designed to provide documentation of preparation, handling, storage, and shipping of all samples collected during this investigation. The samples collected from the site will be the responsibility of authorized personnel from the time they are collected until they, or their derived data, are incorporated into the final report. Stringent chain-of-custody procedures as documented in the QAPP will be followed to maintain and document sample possession.

##### **4.1 SAMPLE IDENTIFICATION SYSTEM**

A sample identification system has been developed to enable the field personnel to establish unique and appropriate identifications for each sample collected. This system incorporates identifiers for the sample matrix, the sample location and the sample number. The identification system has been designed to give reference to previously existing sample location identification numbers. The identification number will consist of the site identification (NSL), sample matrix code, sample location code and sample number, as described below.

**Sample Matrix Code.** This code includes field quality control samples. The sample matrix code will be a two letter (alpha) code that describes the type of sample matrix. The following codes will be used:

o	Ground Water	MW
o	Leachate/Ground-Water From Collection System	L/GW
o	Field Blank	FW
o	Equipment Blank (Water)	EW
o	Equipment Blank (Air)	EA
o	Trip Blank	TW
o	Replicate	ID



**Sample Location Code.** The sample location code will be a two digit numeric code that identifies the sampling location for a particular matrix. It will be added as a suffix to the matrix code.

**Sample Number Code.** The sample number code will be a two digit numeric code that will identify the number of samples collected from a single sampling location.

The following numbers are provided as examples to illustrate the use of the system:

Ground-Water Samples:

NSL-MW-05-06

Leachate/Ground-Water Collection System Samples:

NSL-L/GW-01-02

Field QC Samples:

Field Blanks: NSL-FW-02

Equipment Blanks: NSL-EW-02

Trip Blanks: NSL-TW-02

## **4.2 INITIATION OF FIELD CUSTODY PROCEDURE**

Chain-of-custody procedures will be followed as described in the QAPP. The field personnel are responsible for the care and custody of the sample collected until the samples are properly and formally transferred to another person or facility.

To simplify the chain-of-custody record and eliminate potential litigation problems, as few people as possible should handle the sample or physical evidence during the investigation or inspection. All field documentation shall be completed using waterproof, indelible ink on pre-printed forms or in bound field logbooks.

A chain-of-custody record will be completed for all samples or physical evidence collected. A separate chain-of-custody record will be utilized for each final destination or laboratory utilized during the inspection or investigation. An example of the chain-of-custody form that will be used during this investigation is provided in the QAPP.

During the course and at the end of each sampling event, the NSL Trust Representative will determine whether these procedures have been adequately followed, and/or if the collection of additional samples is required to protect the integrity of sample data.

### **4.3 FIELD ACTIVITY DOCUMENTATION / LOGBOOK**

Documentation of field operations and sample custody is achieved through use of pre-printed forms and the field logbook. The field log consists of notes and drawings describing the location, field conditions, and method of sample collection and identification.

All aspects of sample collection and handling as well as visual observations shall be documented in the field logbooks. All sample collection equipment (where appropriate), field analytical equipment, and equipment utilized to make physical measurements shall be identified in the field logbooks as outlined in this manual and in the QAPP. All calculations, results, and calibration data for field sampling, field analytical, and field physical measurement equipment shall be recorded in the field logbooks. All field analyses and measurements must be traceable to the specific piece of field equipment utilized and to the field investigator collecting the sample, making the measurement, or performing the analyses.

All entries in field logbooks or pre-printed forms shall be dated, shall be legible, and shall contain accurate and inclusive documentation of an individual's project activities. Since field records are the basis for later written reports, language should be objective, factual, and free of personal feelings or other inappropriate terminology. At the end of each day's

activity, or of a particular event as appropriate, all documents in the field will be secured by the field manager for each task. Once completed, these field logbooks and/or pre-printed forms become accountable documents and must be maintained as part of project files.

#### **4.4 SAMPLE SHIPMENT AND TRANSFER OF CUSTODY**

All physical evidence or sample sets shall be accompanied by a chain-of-custody form. Prior to shipment or transfer of custody, all samples will be maintained in the custody of the field manager. Upon transfer of custody, the chain-of-custody form will be signed and dated by the field manager. The individuals receiving the samples shall sign, date, and note the time that they received the samples on the chain-of-custody form. This form documents transfer of custody of samples from the field investigator to another person, to the laboratories or other organizational elements.

Samples shall be properly packaged for shipment and delivered or shipped to the designated laboratory for analyses. Because common carriers (Federal Express, Airborne Express, etc.) will not sign chain-of-custody records, the original chain-of-custody form and one copy of the form will be placed in a plastic bag inside the secured shipping container when samples are shipped. One copy of the record will be retained by the task field manager.

Because the holding time for hexavalent chromium analyses is 24 hours, sample collection of ground-water samples or landfill leachate will not begin prior to 12 noon Eastern Standard Time, unless a local laboratory is used. Samples collected for hexavalent chromium will be shipped the same day via Federal Express for receipt by the laboratory prior to 10:00 A.M. the following day. This will allow the contract laboratory sufficient time to initiate sample analysis after the samples are received the following morning.

Shipping containers shall be secured by using nylon strapping tape and custody seals. The signed and dated custody seal (as provided in the QAPP) will be placed over the lid

of the sample cooler to indicate if the cooler has been opened during shipment prior to receipt by the laboratory. The original chain-of-custody form will be transmitted to the project manager after samples are accepted by the laboratory. This copy will become a part of the project file.

When samples are split with a facility, state regulatory agency, or other government agency, the facility, state regulatory agency, or other government agency representatives shall sign the chain-of-custody form if the party receiving the split is present, otherwise the sample with signed chain-of-custody forms will be shipped to that party, similar to shipping samples to a laboratory.

## **5.0 SAMPLE CONTAINERS PREPARATION, SAMPLE PRESERVATION, AND MAXIMUM HOLDING TIME**

Procedures for selecting appropriate sample containers are dictated by the analyses required. Sample volume, collection container type, preservatives, and holding times for each analytical method performed by the contracted environmental laboratories are provided in Table 5-1.

### **5.1 SAMPLE CONTAINERS**

All environmental sample containers will be provided by the contract laboratories selected to provide analytical support for this project. Each laboratory will include a shipping form listing all containers shipped and specifying the purpose of each container. The laboratory list will become part of the chain-of-custody records maintained in the project files.

Sample containers utilized to collect organic or inorganic environmental samples will be new, pre-cleaned, and pre-baked according to the procedures specified in the analytical methods. All sample containers will be kept closed and in the cooler until use.

### **5.2 SAMPLE LABELS**

Sample labels are necessary to properly identify the samples. An example of the sample label to be placed on each sample container is provided in the QAPP. Sample labels shall be filled out in waterproof ink at the time of sampling and shall be affixed to the sample container (not the caps) prior to the time of sampling. The sample label shall include the following information:

- 1) Sample identification number;
- 2) Initials of collector;

- 3) Date and time of collection;
- 4) Project number (as appropriate);
- 5) Analysis needed (parameters and method);
- 6) Sample matrix (ground-water, surface, water, soil, sediment, etc.); and
- 7) Preservative as appropriate.

### **5.3 SAMPLE PRESERVATION**

Samples for some analyses must be preserved in order to maintain their integrity. Preservatives required for routine analyses of samples are given in Table 5-1. All chemical preservatives used will be supplied by the contract laboratories. All samples should be preserved immediately upon collection in the field. The only samples that should not be preserved immediately in the field are the following:

- (1) Samples collected within a waste site that are thought to potentially contain hazardous materials (i.e., closed containers, barrels, drums, spillage, other source samples, etc.). These samples may be preserved with ice, if necessary.
- (2) Samples that have extremely low or high pH or samples that may generate potentially dangerous gases if they are preserved.
- (3) Samples for metals analyses which are shipped by air shall not be preserved with nitric acid in excess of the amount specified in Table 5-1.
- (4) Samples for purgeable organic compounds (VOC) analyses which are shipped by air shall not be preserved with hydrochloric acid in excess of the amount specified in Table 5-1.

- (5) Samples for cyanide analyses that are found to contain sulfides based on the field screening procedures presented as Attachment 1 of this FSP.

All samples preserved with chemicals shall be clearly identified by indicating on the sample tag that the sample is preserved. If the samples were not preserved, field records shall state why preservation was not used.

#### **5.4 SAMPLE HOLDING TIMES**

The elapsed time between sample collection and initiation of laboratory analyses must be within a prescribed time frame for each individual analysis to be performed. Sample holding times for routine organic and inorganic environmental sample analyses are shown in Table 5-1.

Because the holding time for hexavalent chromium analyses is 24 hours, sample collection of ground-water samples or landfill leachate will not begin prior to 12 noon Eastern Standard Time, unless a local laboratory is used. This will allow the contract laboratory sufficient time to initiate sample analysis after the samples are received the following morning.

## **6.0 SAMPLE HANDLING, PACKAGING, AND SHIPMENT**

### **6.1 SAMPLE HANDLING**

During sample collection and handling, extreme care must be taken to prevent cross-contamination of samples where compounds may be detected at trace levels (parts per billion and/or parts-per-trillion range). The following precautions shall be taken when trace contaminants are of concern:

- (1) A clean pair of new, disposable gloves will be worn each time a different location is sampled;
- (2) Samples collected that are suspected of containing high concentrations of the constituents of concern shall be placed in separate plastic bags immediately after preservation, labeling, etc.;
- (3) If possible, ambient samples and source samples should be collected by different field teams. If separate collection is not possible, all ambient samples shall be collected first and placed in separate ice chests or shipping containers. Samples of waste materials or materials suspected to contain high constituent concentrations shall never be placed in the same ice chest as environmental samples. It is good practice to pack source samples according to the procedures specified in Section 4.4 as soon as possible after collection.
- (4) If possible, one member of the field team should take the notes, fill out labels, etc., while the other member does the sampling.
- (5) Personnel should use equipment constructed of Teflon™, stainless steel, or glass that has been properly precleaned for collecting samples for trace levels of metals or organic compounds analyses. Teflon™ or glass is preferred for



collecting samples where trace metals are of concern. Equipment constructed of plastic or PVC shall not be used to collect samples for trace organic compounds analyses.

After collection, all samples should be handled as few times and by as few people as possible.

## **6.2 SAMPLE MIXING**

Once a sample has been collected, it may have to be mixed prior to placement in the sample container. Liquid samples for analysis of constituents other than VOCs will be mixed by stirring the sample contents continually with a clean pipette or precleaned Teflon™ rod and allow the contents to be poured or alternately siphoned into respective sample containers using Teflon™ tubing. Any device used for stirring, or tubing used for siphoning, must be cleaned in the same manner as other equipment.

## **6.3 SAMPLE PACKING**

Samples collected during the field activities must be classified as either environmental or hazardous material samples in accordance with the Code of Federal Regulations (49 CFR 171 through 177) and the "National Guidance Package for Compliance with Department of Transportation Regulations in the Shipment of Environmental Laboratory Samples" prior to packaging and shipping. Samples collected during this project are anticipated to be classified as environmental samples. These include ground water from monitoring wells and landfill leachate.

### **6.3.1 Packing Environmental Samples**

Field personnel should use appropriate procedures to ensure sample integrity during shipment. When samples are packaged using wet ice, personnel should place them within

the cooler so that melted ice cannot cause sample containers to become submerged, as this may result in sample cross-contamination. Plastic bags, such as Ziplock™ bags, should be used when small sample containers (e.g., VOC samples) are placed in ice chests to prevent potential cross-contamination.

Environmental samples shall be packed prior to shipment by air using the following procedures:

1. Select a sturdy cooler in good repair. Secure and tape the drain plug with fiber tape. Line the cooler with a large heavy duty plastic bag.
2. Allow sufficient outage (ullage) in all bottles (except VOCs) to compensate for any pressure and temperature changes (approximately 10 percent of the volume of the container).
3. Be sure the lids on all bottles are tight (will not leak) and then secure the lid to the bottle with tape to ensure that the lid will not vibrate loose during transport.
4. Place all bottles in separate and appropriately sized polyethylene bubble pack bags and seal the bags with tape.
5. Place paired 40-ml VOC vials into separate polyethylene bubble pack bags and seal with tape.
6. Place plastic bags filled with ice in the bottom of the cooler and place the bottles and cans in the cooler. Then cover the samples with additional bags of ice.
7. Securely fasten the top of the large garbage bag with tape.

8. Place completed chain-of-custody forms into the cooler and then close the cooler and securely tape (preferably with fiber tape) the top of the cooler shut. Chain-of-custody seals should be affixed to the top and sides of the cooler so that the cooler cannot be opened without breaking the seal.
9. The shipping containers must be marked "THIS END UP," and arrow labels which indicate the proper upward position of the container should be affixed to the container. A label containing the name and address of the shipper shall be placed on the outside of the container.

Labels used in the shipment of hazardous materials (such as Cargo Only Aircraft, Flammable Solids, etc.) are not permitted to be on the outside of the container used to transport environmental samples and shall not be used.

#### **6.4 SHIPMENT OF SAMPLES**

The shipment of samples designated as environmental samples are not regulated by the US-DOT. However, these samples must be transported in such a manner as to preserve their integrity. Samples collected by field personnel and designated as environmental samples shall be shipped using a common carrier such as Federal Express or United Parcel Service. If the environmental samples are preserved, the amount of preservative must not exceed the amounts indicated in Table 6-1.

If, based on field observations, field screening data, and professional judgement, a sample is suspected to contain a hazardous material, then the sample shall be packaged and shipped in accordance with procedures described in 49 CFR 171 through 177. In addition, the shipment of pre-preserved sample containers or bottles of preservatives (i.e., NaOH pellets, HCl, etc.) which are designated as hazardous under the US-DOT, Hazardous Materials Tables, 49 CFR 172.101, must be shipped pursuant to the appropriate US-DOT

regulations. As indicated above, the common carriers will provide support in assessing the appropriate method of shipment for hazardous materials.

Because the holding time for hexavalent chromium analyses is 24 hours, ground-water and leachate samples will be collected after noon unless a local laboratory is used and shipped at the end of each work day for next morning delivery to the laboratory. In addition, prior to shipment of samples for hexavalent chromium analyses, the laboratory will be notified of the shipment and provided the air bill number to facilitate tracking the package in the event that delivery is delayed.

## **7.0 DECONTAMINATION PROCEDURES**

The process of removing sample residues that may have accumulated on personnel and equipment is critical to personnel protection and analytical integrity during the investigation.

### **7.1 PERSONNEL AND EQUIPMENT**

Decontamination procedures for personnel and equipment to be used during this investigation are provided in the site specific "Health and Safety Plan For RD/RA; Northside Sanitary Landfill; Zionsville, Indiana", (HASP), Geraghty & Miller, June 1993.

### **7.2 SAMPLE BOTTLES**

Decontamination procedures for analytical sample collection containers are documented in the comprehensive quality assurance plans for each environmental laboratory as presented in the QAPP.

### **7.3 SAMPLING DEVICES**

Sampling cleaning procedures (pre- and post-sampling) will be conducted in accordance with procedures presented in Attachment 2 of this Verification Monitoring Plan.

## **8.0 SAMPLING EQUIPMENT AND PROCEDURES**

Sampling equipment and procedures for the verification monitoring plan tasks are described below.

### **8.1 PREPARATION FOR FIELD SAMPLING TASKS**

Prior to initiating the various sampling events, the field personnel will be adequately prepared. The following items may be required for the field sampling and should be prepared before mobilizing:

- 1) Site map, names of contacts, and access keys;
- 2) Sampling logs, chain-of-custody forms, sample labels, waterproof-ink pen, and tape;
- 3) Sample containers (check for proper number, type, and preservatives), coolers, and ice;
- 4) Cooler custody seals;
- 5) Water-level measurement equipment;
- 6) Well purging equipment;
- 7) Ground water and leachate sampling equipment;
- 8) Field analysis (pH, temperature, specific conductivity, and explosimeters) instruments;
- 9) Teflon™-coated cord or wire or disposable nylon rope, knife, and miscellaneous tools;
- 10) Gloves and towels;
- 11) Laboratory grade detergent and deionized water;
- 12) 5-gallon buckets;
- 13) Power sources for pumps (i.e., portable generator);
- 14) Filtering equipment for dissolved metals;
- 15) Distilled or deionized, organic-free water, hydrogen and zero air;

- 16) Aluminum foil; and
- 17) Plastic sheeting (ground cover).

All equipment must be checked for proper operation. Equipment that will come in contact with the ground water must be properly decontaminated before use (see Attachment 2).

Arrangements for site access are to be finalized prior to leaving for the site location. Upon arriving at the site, the field personnel should inform appropriate people of their presence and the approximate time they will be at the site.

## **8.2 HYDROGEOLOGIC MEASUREMENTS**

Hydrogeologic measurements will be conducted in the five designated perimeter monitoring wells and lift-station sump to update information related to the shallow ground-water flow system at the NSL site.

### **8.2.1 Water Level-Elevations**

A water-level measuring point (top of casing) will be established at each monitoring well location, and the elevation of that measuring point will be determined to within  $\pm 0.01$  feet relative to mean sea level by a licensed, Indiana professional surveyor. The horizontal location of each well will also be surveyed to within  $\pm 1$  foot relative to the Indiana State Plane Coordinate System. This information will be used to verify the position of each well on the site map. Depth-to-water measurements from the top of casing will also be collected from each of the monitoring wells using an electronic water-level probe. Measurements will be referenced to the survey point (top of well casing) and will be recorded to the nearest 0.01 foot. Water-level measurements will be made for comparison purposes each time samples are collected.

### **8.2.2 Water-Quality Sampling**

The monitor well and leachate collection system water-quality data will provide a current assessment of ground-water quality at the site. It will also allow for a direct tabular comparison with previously collected data and an evaluation of changes in water quality with time. Samples will be obtained using the procedures discussed in Section 6.0 and submitted to the selected laboratory for analysis in accordance with the QAPP.

### **8.2.3 Landfill Leachate Characterization**

Leachate samples will be collected from the discharge piping from the lift station. Leachate samples will be visually characterized and measured for pH, specific conductance, temperature, and sulfides (for cyanide samples) in the field. One leachate sample will be collected using the procedures described below and submitted for laboratory analysis for a selected list of organic and inorganic parameters as presented in the QAPP.



## **9.0 FIELD MEASUREMENTS/SCREENING**

A specific calibration and/or standardization plan for the various field analytical equipment to be used is presented in this section. Included in this plan are: calibration and maintenance intervals; listing of required calibration standards; environmental conditions requiring recalibration; and use of a logbook to record calibration and maintenance data for each piece of field analytical equipment.

### **9.1 TEMPERATURE**

- (a) **Initial Calibration** -- All thermometers and thermocouples shall be annually calibrated against a National Institute of Standards and Technology (NIST) certified thermometer or one traceable to NIST certification.
- (b) **Inspection and Calibration** -- Each glass mercury filled thermometer shall be inspected before each field trip to see that it is not cracked and does not have air spaced in the mercury column. If a mechanical dial-type thermometer is used, it should not have a broken face cover or otherwise show damage. Thermistors and electronic readout units should be calibrated in the same manner. Recording thermometers shall be checked for recording accuracy before each use. The recorder time scale accuracy shall be checked semi-annually. Before using a thermometer in the field, a visual observation shall be made to assure that it has not been damaged. If a thermistor is used, the instrument shall be checked against a calibrated thermometer before field use. Cross-checks and duplicate field analyses should agree within  $\pm 0.2^{\circ}\text{C}$ .
- (c) **Calibration Records** -- A logbook shall be maintained with each thermometer number and/or equipment property number recorded. All calibration information, individuals making the calibrations, and dates of calibration, shall

be recorded. Each field calibration shall be noted in the field logbook indicating the temperature readings observed.

- (d) Reporting Units -- Report all temperature data to the nearest 0.5°C.
- (e) Method for Measuring Temperature
  - (1) Scope and Application. This method is applicable to ground, surface, and saline waters as well as domestic and industrial waste.
  - (2) Summary of Method. Temperature measurements may be made with any high quality mercury-filled thermometer or thermistor with analog or digital read-out device.
  - (3) Comments. Measurement device shall be routinely checked against a precision thermometer.
  - (4) Test Procedure.
    - (a) Use only a previously calibrated mercury-filled thermometer or thermistor that has been inspected according to the procedure outlined above.
    - (b) Allow thermometer or thermistor enough time to equilibrate to outside temperature when removed from a field vehicle.
    - (c) Insert thermometer or thermistor in-situ when possible or in a grab sample. Swirl the thermometer or thermistor in the sample and take the temperature reading when the mercury column or read-out needle moves less than 0.5°C per minute; record temperature to the nearest 0.5°C.

- (5) Precision and Accuracy. Precision and accuracy for this method have not been determined.

(f) References.

Standard Methods for the Examination of Water and Wastewater, 15th Edition, p. 124, Method 2122

Methods for Chemical Analyses of Water and Wastes, US-EPA, 170.1 (1979).

## 9.2 pH

- (a) Equipment -- Only electronic (portable) meters with provisions for temperature compensation should be used. Temperature resistant combination electrodes should be used in conjunction with the meters. (pH test paper will be used only for determining pH ranges or for determining approximate pH values.)
- (b) Equipment Inspection and Calibration -- The pH meter shall be checked before each field trip for any mechanical or electrical failures, weak batteries, and cracked or fouled electrodes. The slope of the meter shall also be checked initially with three fresh standard buffer solutions (e.g., 4, 7, and 10). All pH recorders shall be checked for recording accuracy and time scale accuracy. While in the field, the meter shall be calibrated daily before use with two buffers bracketing the expected sample pH. Thereafter, the meter shall be periodically checked against the two buffers during the work day. Fresh buffer solutions should be used for each day. In case of an apparent pH violation, the electrode shall be checked with pH 7.0 buffer and recalibrated to the closest reference buffer. Then the sample shall be retested. Duplicate analyses should agree within 0.1 standard units.

- (c) **Records** -- A logbook shall be maintained and will contain the property number of each pH meter. All calibrations and repairs should be noted in the logbook indicating the date, repairs made, person making repairs, and calibration records.
- (d) **Reporting Units** -- Report pH to the nearest 0.1 standard unit.
- (e) **Method for Measuring pH.**
  - (1) **Scope and Application.** This method is applicable to ground, surface, and saline waters, as well as domestic and industrial wastes.
  - (2) **Summary of Method.** The pH of a sample is determined electrometrically using either a glass electrode in combination with a reference potential or a combination electrode, and a pH meter.
  - (3) **Interferences**
    - (a) The glass electrode, in general, is not subject to solution interferences from color, turbidity, colloidal matter, oxidants, reductants, or high salinity.
    - (b) Errors due to the presence of sodium at pH levels greater than 10 can be reduced or eliminated by using a "low sodium error" electrode.
    - (c) Coatings of oily material or particulate matter can impair electrode response. Remove these coatings by gentle wiping with a laboratory tissue followed by a distilled water rinse.

- (d) Temperature effects on the electrometric measurement of pH are controlled by using instruments having temperature compensation or by calibrating the electrode meter system at the temperature of the samples.
  - (e) Poorly buffered solutions with low specific conductance values (less than 10 umhos) may cause fluctuations in the pH readings. Equilibrate electrode by immersing in several portions of sample before taking pH measurement.
- (4) **Reagents.** Secondary standard buffer solutions (pH 4, pH 7, and pH 10) purchased from commercial vendors shall be used.
- (5) **Buffering**
  - (a) Follow the instructions provided with each type of pH meter.
  - (b) Each meter/electrode system must be buffered at a minimum of two points that bracket the expected pH of the samples and that are approximately three pH units or more apart. Approximate pH values may be obtained by using multi-range pH paper.
- (6) **Test Procedure**
  - (a) Allow the meter to equilibrate to ambient temperature when it is removed from a field vehicle.
  - (b) Buffer the meter at the temperature of the buffer solution as outlined above in Section 5.

- (c) If the sample temperature differs more than 2°C from the buffer solutions, adjust for the temperature differences.
- (d) Thoroughly rinse the electrode with distilled water.
- (e) Immerse the electrode in-situ when possible or in a grab sample. Swirl the electrode at a constant rate until the meter reading reaches equilibrium. The rate of stirring used should minimize the air transfer rate at the air-water interface of the sample.
- (f) Note and record sample pH; repeat measurement on successive volumes of sample or in-situ until values differ by less than 0.1 pH unit. Two or three volumes are usually sufficient.
- (g) In the case of low specific conductance samples, such as encountered with some ground waters, add 1 mL of 1M potassium chloride solution per 100 mL of sample and follow steps e and f.
- (h) When the meter is moved to another sampling location, recheck the meter calibration by inserting the probe into the pH 7 buffer solution and follow steps 7F through 7L (below).

(7) Calibration Method for Most Field pH Meters

- (a) Check sample with pH paper to determine proper pH buffer range.
- (b) Turn on pH meter and check battery.

- (c) Turn function switch to pH position.
- (d) Select two buffer solutions (based on pH paper reading); one buffer solution shall be pH 7. Choose a second buffer so that the two bracket the anticipated sample pH.
- (e) Place pH electrode into pH 7 buffer solution.
- (f) Turn calibration control until the meter needle or digital display reads the pH value of the buffer.
- (g) Remove the electrode from the pH 7 buffer and rinse with distilled water.
- (h) Place electrode into the second pH buffer solution (pH 4 or pH 10).
- (i) Turn the temperature compensator knob or slope adjustment until the meter needle or digital display reads the pH value of the buffer solution (pH 4 or pH 10).
- (j) Measure the temperature of the second buffer solution.
- (k) Adjust the slope until the arrow of the temperature compensator points to the actual temperature of the buffer. The percent of the theoretical slope can be read on the slope scale or directly from the digital display. A slope of less than 90 percent may be caused by a defective electrode or contaminated buffer. If a slope of less than 90 percent is obtained, correct the problem before proceeding.

- (l) Remove electrode from buffer and rinse thoroughly with distilled water.
  - (m) Measure the temperature of a fresh grab sample.
  - (n) For non-temperature compensated instruments, turn the slope indicator until the arrow of the temperature compensator points to the temperature of the solution.
  - (o) Place the electrode into the sample, swirl and read pH value. In case of low specific conductance and meter drift, add 1 mL of 1M KCl solution to each 100 mL of sample, swirl sample and read pH.
  - (p) Turn off meter after last reading.
  - (q) Rinse electrode and store in rubber cap with pH 7 buffer.
- (8) Precision and Accuracy. Under normal conditions, the accuracy is  $\pm$  0.2 pH unit.

(f) References

Standard Methods for the Examination of Wastewater, 15th Edition, p. 402, Method 423 (1980).

Instruction Manual for Models 399 A/F, 399 Analog pH Meter, Orion Research Incorporated, 1983.

Annual Book of ASTM Standards, Part 31, "Water," Standard D1293-78(B).



Methods for Chemical Analysis of Water and Wastes, US-EPA, 150.1 (1979).

Procedure No. 501, pH Measurement in Low Ionic Strength Solutions, Orion Application Information, Orion Research Incorporated.

### 9.3 SPECIFIC CONDUCTANCE

- (a) Equipment -- A portable specific conductance meter, Wheatstone bridge type or equivalent should be used.
- (b) Inspection and Calibration -- Each conductivity meter shall be checked before every field trip. Batteries shall be checked, and conductivity cells shall be cleaned and checked against known conductivity standards (KCl).
- (c) Field Calibration -- Before using in the field, check instrument daily with known standards. Refer to the instrument instructions for temperature-conductance calculations. Duplicate field analyses should agree within  $\pm 10$  percent.
- (d) Calibration and Repair Records -- A logbook shall be maintained with all specific conductance meter property numbers. All repairs and calibrations shall be noted. The logbook shall include all calibrations and repair information along with the name of the person making the repair.
- (e) Reporting Units -- Results should be expressed in micromhos/centimeter (umhos/cm) corrected to 25°C. Results should be reported to the nearest ten units for readings under 1,000 umhos/cm and the nearest 100 units for readings over 1,000 umhos/cm.

(f) **Method for Measuring Specific Conductance**

(1) **Scope and Application.** This method is applicable to ground, surface, and saline waters, as well as domestic and industrial wastes.

(2) **Summary of Method**

(a) The specific conductance of a sample is measured by use of a self-contained conductivity meter, Wheatstone bridge-type, or equivalent.

(b) Samples are preferably analyzed at 25°C. If not, temperature corrections are made and results reported at 25°C.

(3) **Test Procedure**

(a) Follow instructions manual for Beckman SoluBridge™ Model RB-5/RB-6 field conductivity meter or specific instructions for any other conductivity meter used.

(b) Check the meter with two standard solutions near 100 and 1,000 umhos/cm. If the meter does not read within 2 percent of the standards, determine what the problem is and correct it before proceeding. Most field instruments read conductivity directly; with those instruments, follow the manufacturer's instructions. Report the results to the nearest ten units for readings under 1,000 umhos/cm and the nearest 100 units for readings over 1,000 umhos/cm.

- (c) Record the actual sample temperature when the measurement is made. Convert the meter reading to specific conductance at 25°C using the information in the manufacturer's instruction manual.

- (4) Precision and Accuracy. Beckman Model RB-6 conductivity meter has an accuracy of  $\pm 2$  percent of reading. With satisfactory equipment, results within 1 percent of the true value should be obtained.

(g) References

Standard Methods for the Examination of Water and Wastewater, 15th Edition, p. 70, Method 205 (1980).

Annual Book of ASTM Standards, Part 31, "Water," Standard D1125-64, p. 120 (1976).

Methods for Chemical Analysis of Water and Wastes, US-EPA, 120.1 (1979).

Instruction Manual, SoluBridge™ RB-6, Beckman Instruments, Inc., Rev. January 1982.

#### 9.4 ORGANIC VAPOR ANALYZER (if required)

- (a) Equipment -- The Foxboro Organic Vapor Analyzer (OVA), equipped with a flame ionization detector (FID), is capable of measuring all volatile organic vapors, including methane. In all instances, measurements with and without the use of an activated charcoal filter should be performed to discriminate between VOCs and methane gas.

(b) **Equipment Inspection and Calibration**

- (1) Internal calibration of the OVA should be checked on receipt by the following procedure.
- (2) The instrument must be operated in accordance with the manufacturer's instructions. The instruction manual is provided with the instrument and a summary is printed on the inside of the instrument cover. The battery should be tested before trying to operate the instrument. If the battery is not properly charged, operation could damage it severely.
- (3) To use the instrument the hydrogen storage tank in the instrument must be charged. This is accomplished by connecting a hydrogen gas tank line to the inlet valve on the OVA, opening the valve on the instrument and then on the hydrogen tank. This procedure should be accomplished in a well ventilated area. Since hydrogen is flammable and explosive, extreme care should be taken when charging the hydrogen cylinder on the instrument.
- (4) After charging the hydrogen cylinder and with all valves closed, install the probe lines in the ports as directed by the manufacturer's instructions.
- (5) Turn on the instrument switch to "ON" and allow the instrument electronics to warm up for five minutes. After warm up, the vacuum pump should be turned on, the flow rate checked (per manufacturer's instructions) and the instrument may be "fired" up by opening the gas valve to the detector chamber, waiting one minute and depressing the

ignition button. A slight "pop" may be heard when the FID ignites and the needle on the probe gauge will move.

- (6) Set the Gas Select Control on 300.
  - (7) With the instrument set on the low 1X value, the instrument reading should be adjusted to zero (ambient) with the calibrate adjust.
  - (8) To test the calibration, the probe should be hooked to a gas supply of "zero" air to ensure it will remain at zero. Then the probe should be connected to a tank containing approximately 100 ppm methane gas and the instrument setting turned to the 10X scale. If the instrument has been properly calibrated by the lessor, the result should read within 10 percent of the true value of the standard gas.
  - (9) If it is not within this control limit, the instrument should be adjusted. Consult the operating manual to remove the instrument cover. Locate the potentiometer on the lower back side of the electronics panel. Adjust the potentiometer (R32) until the instrument reads the correct concentration.
  - (10) Samples may now be tested.
- (c) Records -- A log book shall be maintained and will contain the property number of the instrument. All initial calibrations and repairs should be noted in the logbook indicating the date, repairs made, person making the repairs and calibration records. Periodic calibration checks shall be recorded in the field logbooks.

(d) Reporting Units -- Report results to the nearest part per million (ppm) as methane.

(e) Test Procedure

(1) Soil gases will be analyzed in situ at the boreholes at varying depths. After the soil gas probe has been appropriately installed at the location, attach a sampling pump (peristaltic or bladder) to the soil gas probe and inflate a clean Tedlar™ bag.

(2) Calibrate the instrument according to the procedures stated in 8.4.(b) above. Open the valve on the Tedlar™ bag and connect the Tedlar™ bag to the unfiltered OVA probe using a short length of Tygon™ tubing. Read and record the volatile gas measurements appropriately.

(3) Reanalyze the soil gases for methane using steps (1) through (4) above using the filtered OVA probe. Read and record the data obtained appropriately.

(f) References

Foxboro Company. Model OVA 128 Century Organic Vapor Analyzer. Instrument Manual, December 1985.

## **9.5 EXPLOSIMETER/OXYGEN METER (if required)**

(a) Equipment -- Gas Tech GX-91 or equivalent meter with combination explosive gas and oxygen detectors. A percent methane function is also desirable. The instrument should use a pump to draw ambient gases through

the detectors. Instruments without pumps are not acceptable for landfill gas or soil gas monitoring.

- (b) Equipment Inspection and Calibration -- The instrument should be inspected prior to each use for battery charge and adequate pump operation. Tubing connections should be checked for leaks and filters in intake hoses should be cleaned or replaced. For landfill gas investigations, the explosion sensor should be calibrated with commercially available mixture of one percent methane in air or 20 percent of the lower explosive limit (LEL) and zero grade air. The oxygen sensor will be checked using ambient air and a commercially available mixture of gas containing approximately 10 percent oxygen. If the instrument is equipped to measure methane directly, the methane sensor will be calibrated with a commercially available mixture of 10 to 20 percent methane in air. Instrument calibrations will be performed daily prior to initiating field work and then checked periodically throughout the day as ambient conditions change.

(c) Method for Measuring Explosive Gases, Oxygen and Methane in Soil Gas.

- (1) Scope and Application. This method is applicable to measurement of soil gas and landfill gases as well as discharges from active gas extraction systems.
- (2) Summary of Method. The percent of methane and oxygen as well as the percent LEL of the soil gas mixtures are measured by electrochemical sensors in the instrument.
- (3) Interferences.
  - a. The oxygen sensor is free from interferences.

- b. The LEL sensor responds to a variety of gases each having its own response factor and sensitivity. Therefore the accuracy of the reading is affected by how accurately the mixture of gases in the calibration standard match the mixture of gases encountered in the field.
  - c. The methane sensor is also affected by other hydrocarbons. Therefore, the accuracy reading is dependent on the concentration of other hydrocarbons that may be present in the sample.
- (4) Reagents. Cylinder of zero air and commercially available calibration gases containing 10 to 20 percent methane, 1 percent methane, and approximately 10 percent oxygen.
- (5) Test Procedure.
- a. Turn the instrument on and allow it to warm up for approximately five minutes. Some instruments will go through an internal diagnostic routine. Monitor the routine to assure that the instrument is in good working order.
  - b. Check the charge on the battery.
  - c. Seal off the end of the intake tubing. The pump should loose flow (as indicated by sound or the flow ball) and an instrument alarm should sound. If the flow is unchanged check the tubing, both internal and external for leaks.



- d. Fill a clean Tedlar™ bag with zero air and connect the bag to the instrument intake. The instrument should read 0 percent methane, 0 percent LEL and 21 percent oxygen. If the instrument doesn't read these values calibrate the instrument using the manufacturers instructions.
  - e. Fill a second clean Tedlar™ bag with a standard. Check the instrument reading and adjust the instrument according to the manufacturers directions. **If the instrument will not calibrate do not use the instrument.**
  - f. To measure either soil gas or landfill gas, use a peristaltic pump or bladder pump to fill a Tedlar™ bag with sample. Seal the bag.
  - g. Connect the intake tube of the instrument directly to the fitting on the bag and open the valve. Allow a thirty seconds to a minute for the instrument to stabilize. Read the concentration of gases directly from the meter.
- (6) Precision and Accuracy -- Precision and accuracy criteria have not been developed. Replicate readings should agree within 10 percent.
- (7) References.

Instruction Manual for Model 1939 OXY GasTechtor, Gas Tech.

Instruction Manual for Model 261, Combustible Gas and Oxygen Meter, MSA.

## **10.0 WASTE DISPOSAL**

Wastes resulting from monitoring activities will be disposed of in an environmentally sound manner. The waste disposal procedures used will follow the guidance specified in "Management of Investigation-Derived Wastes During Site Inspections", USEPA, OSWER Directive 9345.3-02, May 1991, and the draft document "Guide to Management of Investigation-Derived Wastes", USEPA, OSWER Publication 9345.3-02FS.

Two distinct waste streams are anticipated to be generated during performance of the Verification Monitoring: 1) purge water from the five monitor wells, and 2) purge water from the single leachate lift station. The liquids collected during these operation will be pumped into the onsite transfer station storage tank for ultimate disposal with the recovered waters from the collection system.

## **TABLES**

**TABLE 2-1**  
**REMEDIATION STANDARDS FOR GROUND WATER AND LEACHATE**  
**NORTHSIDE SANITARY LANDFILL, ZIONSVILLE, INDIANA**

Constituent	Remedial Standard (ug/L)	Reference
1,1,1-Trichloroethane	5280	A
1,1,2-Trichloroethane	41.8	A
Chloroform	15.7	A
Benzene	40	A
Ethylbenzene	3280	A
Methylene Chloride	15.7	A
1,1-Dichloroethene	5	A
Trichloroethene	80.7	A
Tetrachloroethene	8.85	A
Toluene	3400	A
Phenol	570	A
4-Chloro-3-methyl phenol	1	A
Bis(2-ethylhexyl)phthalate	50,000	A
Vinyl chloride	525	A
1,2-Dichloroethane	243	A
Di-n-butyl phthalate	154,000	A
Diethyl phthalate	52,000	A
Dimethyl phthalate	33,000	A
Naphthalene	620	A
Arsenic	0.0175	A
Chromium(VI)	11	A

A - Selected stream criteria in Table 1 of the USEPA Record of Decision, Environmental Conservation and Chemical Corporation and Northside Sanitary Landfill Sites, Zionsville, Indiana, September 25, 1987.

B - Constituents added by the IDEM with associated values.

**TABLE 2-1**  
**REMEDIATION STANDARDS FOR GROUND WATER AND LEACHATE**  
**NORTHSIDE SANITARY LANDFILL, ZIONSVILLE, INDIANA**

Constituent	Remedial Standard (ug/L)	Reference
Copper	26	A
Cyanide	5.2	A
Iron	1000	A
Lead	10	A
Nickel	100	A
Zinc	47	A
Ammonia	1,140 (Summer)	B
	1,640 (Winter)	B
Chloride	230,000	B

A - Selected stream criteria in Table 1 of the USEPA Record of Decision, Environmental Conservation and Chemical Corporation and Northside Sanitary Landfill Sites, Zionsville, Indiana, September 25, 1987.

B - Constituents added by the IDEM with associated values.

**Table 3-1. NSL Target Constituent List for Landfill Gas Samples; QAPjP for Supplemental Investigations; Northside Sanitary Landfill; Zionsville, Indiana.**

<b>Volatile Organics</b>	<b>CAS Number</b>	<b>Quantitation Limits (ug/M<sup>3</sup>)</b>
Benzene	71-43-2	30
Chloroform	67-66-3	30
1,2-Dichloroethane	107-06-2	30
1,1-Dichloroethene	75-35-4	30
Ethyl Benzene	100-41-4	30
Methylene Chloride (1)	75-09-2	70
Tetrachloroethene	127-18-4	30
Toluene (1)	108-88-3	30
1,1,1-Trichloroethane	71-55-6	30
1,1,2-Trichloroethane	79-00-5	30
Trichloroethene	79-01-6	30
Vinyl Chloride	75-01-4	30

**Note: (1) Common laboratory solvent. Control limits for blanks are 5 times the method detection limits.**

**Table 5-1. Sample Container, Preservative, and Holding Time Specifications; Field Sampling Plan for Supplemental Investigations; Northside Sanitary Landfill; Zionsville, Indiana.**

Parameter	Container	Sample Preservative	Holding Time
<b><u>Ground Water/Leachate</u></b>			
Volatile Organics	Three 40-mL glass VOC vials, no headspace	1:1 HCl to pH <2, cool to 4°C	14 days
Base/Neutral/Acid Extractables	Two 1-liter amber glass bottle	Cool to 4°C	Extract in 7 days, analyze within 40 days of extraction
Metals	1-liter polyethylene bottle	HNO <sub>3</sub> to pH <2	6 months, mercury 28 days
Hexavalent Chromium	1-liter polyethylene bottle	Cool to 4°C	24 hours
Cyanide	500 mL polyethylene bottle	NaOH pH >12, cool to 4°C	14 days
Chloride	500 mL polyethylene bottle	cool to 4°C	28 days
Ammonia	500 ml polyethylene bottle	H <sub>2</sub> SO <sub>4</sub> to pH <2 cool to 4°C	28 days
<b><u>Soils/Sediment</u></b>			
Volatile Organics	8-ounce glass	none	14 days
Base/Neutral/Acid Extractables	8-ounce glass	none	Extract in 7 days, analyze within 40 days of extraction
Pesticides/PCBs	8-ounce glass	none	Extract in 7 days, analyze within 40 days of extraction
Metals	8-ounce glass	none	6 months, mercury 28 days
Cyanide	8-ounce glass	none	14 days
<b><u>Landfill Gas</u></b>			
Volatile Organics	Summa™ canister	none	14 days

**Table 6-1. Chemicals Listed in the Hazardous Materials Table (49 CFR 172.101) Used for Preserving Samples; Field Sampling Plan for Supplemental Investigations; Northside Sanitary Landfill; Zionsville, Indiana.**

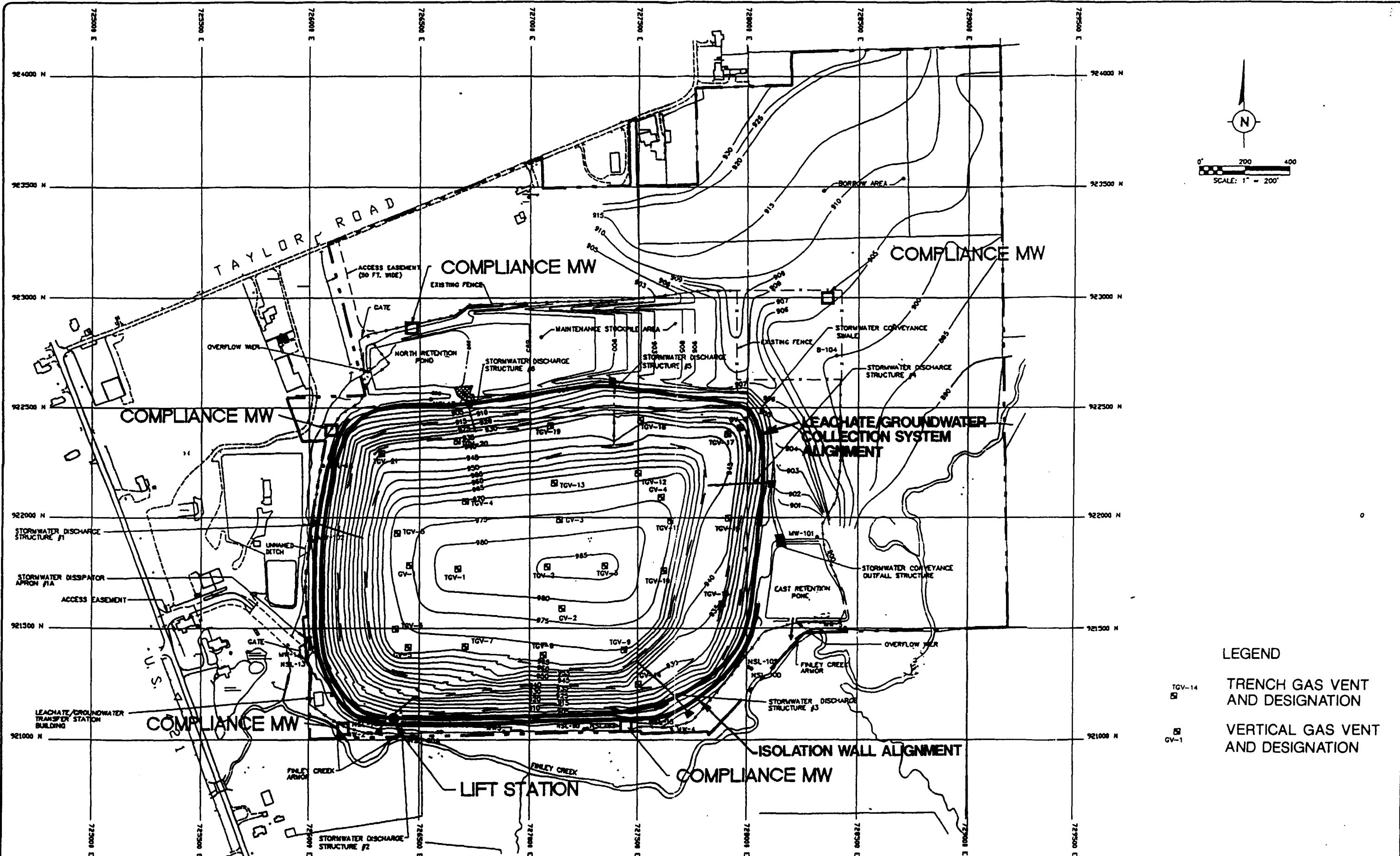
Preservative	Sample Type/Parameter	pH Recommendation	Quantity of Preservative Added Per Liter	Wt. % of Preservative
HCl	Volatile Organic Analysis	<2 - $\geq$ 1	4 drops conc. HCl/40 ml	0.22% (2)
HNO <sub>3</sub>	Metals, Hardness	<2 - $\geq$ 1	5 ml of conc. (70%)	0.35% (1)
H <sub>2</sub> SO <sub>4</sub>	Nitrogen Species COD, Oil & Grease, Organic Carbon, Phenols	<2 - $\geq$ 1	2 ml of 36N	0.35% (1)
NaOH	Cyanides, Sulfides	>12 - $\leq$ 13	2 ml of 10N	0.080% (1)

\* Dry ice is classified as a ORM-A hazard by DOT. There is no labeling requirement for samples preserved with dry ice, but each package must be plainly and durably marked on at least one side or edge with the designation "ORM-A." The package should also be marked "Dry Ice" or "Carbon Dioxide, Solid" and "Frozen Diagnostic Specimens." Samples must be packaged in accordance with the requirements of 40 CFR 173.615 and advance arrangements must be made between the shipper and each carrier.

NA Not Applicable



## **FIGURES**



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REV. NO.	DATE	DESCRIPTION	BY	APPR.

PROJECT NO.	DATE
NSL-100	1/1/00
NSL-101	1/1/00
NSL-102	1/1/00
NSL-103	1/1/00
NSL-104	1/1/00
NSL-105	1/1/00
NSL-106	1/1/00
NSL-107	1/1/00
NSL-108	1/1/00
NSL-109	1/1/00
NSL-110	1/1/00

**VERIFICATION MONITORING LOCATIONS**  
 NSL REMEDIAL DESIGN/REMEDIAL ACTION  
 NORTHSIDE SANITARY LANDFILL  
 ZIONSVILLE, INDIANA

DRAWING NO.  
**1**

**ATTACHMENT 1**

**SAMPLE PRESERVATION PROCEDURES  
FOR CYANIDE SAMPLES WHEN SULFIDE IS PRESENT**

## **ATTACHMENT 1. SAMPLE PRESERVATION PROCEDURES FOR CYANIDE SAMPLES WHEN SULFIDE IS PRESENT**

### **1.1 SUMMARY**

In order to meet EPA requirements for collection of aqueous samples for cyanide analysis, the spot tests for sulfide and oxidizing agents described below should be performed in the field prior to preservation of the sample with sodium hydroxide. Sulfide and oxidizing agents (e.g., chlorine) are interferences in the measurement of cyanide in aqueous samples and must be removed the day of sample collection. Samples must be analyzed for cyanide within 14 days of collection.

[Note: Perform the sulfide spot test first. If positive, it may be assumed that oxidizing agents are not present and therefore the oxidizing agent test need not be performed.]

### **1.2 SULFIDE SPOT TEST AND REMOVAL**

#### **1.2.1 Test Summary**

In general, a small aliquot of the sample will be tested for the presence of sulfide using two techniques: the lead acetate indicator paper spot test and the cadmium nitrate powder spot test. Both tests result in a color change in the presence of sulfide. The lead acetate paper darkens in the presence of sulfide while a yellow precipitate is formed upon addition of cadmium nitrate powder. Both visual tests will be used and if positive, sulfide will be removed before sample preservation. Sulfide is removed as a yellow precipitate by the addition of cadmium nitrate powder and separated from the sample by filtration.

### **1.2.2. Apparatus**

1. Eyedropper or Pasteur<sup>TM</sup> pipette
2. Plastic weighing boat or disposable beaker (for performing spot test)
3. Lead acetate indicator paper
4. Spatula
5. Filtration apparatus
  - a. A suitable apparatus of polyethylene or glass construction to rapidly filter the volume of sample needed should be used. All pieces must be thoroughly cleaned between uses to avoid contamination.
  - b. Filter papers of Whatman #1 grade or equivalent.

### **1.2.3 Reagents**

1. Cadmium nitrate powder [ $\text{Cd}(\text{NO}_3)_2$ ]
2. Sodium acetate buffer solution (pH 4.0)

Dissolve 146 g anhydrous  $\text{NaC}_2\text{H}_3\text{O}_2$ , or 243 g  $\text{NaC}_2\text{H}_3\text{O}_2 \cdot 3\text{H}_2\text{O}$ , in 400 ml distilled water. Add 480 g concentrated acetic acid, and dilute to 1 liter with distilled water.

### **1.2.4 Procedure - Spot Test**

Collect the appropriate volume of sample (at least 1 Liter) in the plastic bottle (Note: do not preserve the sample with NaOH). Pour about 50 ml of the sample into the plastic weighing boat or disposable beaker. The spot tests will be performed on this aliquot.

**1. Lead acetate indicator paper spot test**

- a. Moisten a strip of the lead acetate indicator paper with the sodium acetate buffer solution.
- b. Using an eyedropper or Pasteur<sup>TM</sup> pipette, place a drop of sample to be tested on the moistened lead acetate indicator paper.
- c. Observe any color change of the lead acetate indicator paper. Darkening of the paper indicates the presence of sulfide.
- d. If a positive test should occur, then the sulfide must be removed from the sample by precipitation with cadmium nitrate powder, followed by filtration to remove the cadmium sulfide precipitate (described below, Section A.2.5).

**2. Cadmium nitrate powder addition spot test**

- a. Add a small portion (spatula tip) of cadmium nitrate powder to the sample aliquot. The formation of a yellow precipitate indicates the presence of sulfide.
- b. If a positive test should occur, then the sulfide must be removed from the sample by precipitation with cadmium nitrate powder, followed by filtration to remove the cadmium sulfide precipitate (described below, Section A.2.5).

### **1.2.5 Procedure - Sulfide Removal**

1. If there are any particulates present in the sample (indicated by the presence of sediment on bottom of the sample container or turbidity in the sample), and especially if metal/cyanide complexes are suspected in the sample, then the sample must be filtered (using the same apparatus and paper as for the sulfide precipitation) before sulfide removal. Save the filtered particulates for reconstitution of the sample (step 4 below) once sulfide removal has been completed.
2. To precipitate sulfide from the sample, add cadmium nitrate powder in small amounts (spatula tip) until a drop of treated sample no longer causes the lead acetate indicator paper to darken and a yellow precipitate no longer forms when the cadmium nitrate is added.
3. Filter the sample to remove the cadmium sulfide precipitate. Discard the yellow precipitate.
4. Reconstitute the sample by returning the particulates removed in step (1) with the filter paper to the sample.

### **1.2.6 Quality Control**

A clean distilled water sample should be treated as described above at a frequency of 1 per 10 samples. Label the sample as a cyanide spot test blank (e.g., CN spot test BLK) and note the group of corresponding samples if more than one CN spot test blk was run that day. Send samples to the laboratory for cyanide analysis. This procedure checks for contamination introduced during sample pretreatment.

## **2.3 OXIDIZING AGENT SPOT TEST AND REMOVAL**

### **2.3.1 Test Summary**

In general, a small aliquot of the sample will be tested for the presence of oxidizing agents (e.g., chlorine) using potassium iodide-starch indicator paper. A bluish discoloration of the potassium iodide-starch paper indicates the presence of oxidizing agents. Oxidizing agents can be removed by the addition of ascorbic acid.

### **2.3.2 Apparatus**

1. Eyedropper or Pasteur<sup>TM</sup> pipette
2. Spatula
3. Filtration apparatus
  - a. A suitable apparatus of polyethylene or glass construction to rapidly filter the volume of sample needed should be used. All pieces must be thoroughly cleaned between uses to avoid contamination.
  - b. Filter papers of Whatman #1 grade or equivalent.

### **2.3.3 Reagents**

1. Potassium iodide-starch indicator paper (KI-starch paper)
2. Ascorbic acid, crystal ( $C_6H_8O_6$ )
3. Sodium acetate buffer solution (pH 4.0)

Dissolve 146 g anhydrous  $NaC_2H_3O_2$ , or 243 g  $NaC_2H_3O_2 \cdot 3H_2O$ , in 400 ml distilled water. Add 480 g concentrated acetic acid, and dilute to 1 liter with distilled water.



#### **2.3.4. Procedure**

1. The sample aliquot collected for the spot test procedure, Section A.2, A.2.4 above, may be used for this test.
2. Potassium iodide-starch indicator paper spot test.
  - a. Moisten a strip of KI-starch paper with the sodium acetate buffer solution.
  - b. Using an eyedropper or Pasteur<sup>TM</sup> pipette, place a drop of sample to be tested on the moistened KI-starch paper.
  - c. Observe any color change of the KI-starch paper. A bluish discoloration of the paper indicates the presence of oxidizing agents.
  - d. If a positive test should occur, then the oxidizing agents must be removed by the addition of ascorbic acid.
  - e. If there are any particulates present in the sample, and especially if metal cyanide complexes are suspected in the sample, then the sample must be filtered before oxidizing agents are removed. Save the filtered particulates for reconstitution of the sample (step h) once oxidizing agents have been removed.
  - f. To remove oxidizing agents in the sample, add 0.6 g of ascorbic acid and retest with the KI-starch paper. Repeat addition if necessary.
  - g. When a drop of treated sample no longer discolors the KI-starch paper, an additional 0.6 g of ascorbic acid should be added to the

sample.

- h. Reconstitute the sample by returning the particulates removed in step (e) with the filter paper to the sample.

#### **2.3.5 Quality Control**

A clean distilled water sample should be treated as described above at a frequency of 1 per 10 samples. Label the sample as a cyanide spot test blank (e.g., CN spot test BLK) and note the group of corresponding samples if more than one CN spot test blk was run that day. Send samples to the laboratory for cyanide analysis. This procedure checks for contamination introduced during sample pretreatment.

**ATTACHMENT 2**

**STANDARD CLEANING PROCEDURES**

## **ATTACHMENT 2. STANDARD CLEANING PROCEDURES**

### **1.1 INTRODUCTION**

The cleaning procedures outlined in this attachment are to be used by all personnel to clean sampling and other field equipment. Specific cleaning procedures are presented in the following section. Any deviation from them must be documented in field records.

#### **1.1.1 Cleaning Materials**

The cleaning materials referred to in this attachment are defined in the following paragraphs and also in the QAPP.

The laboratory detergent shall be a standard brand of phosphate-free laboratory detergent such as Micro™, Alquinox™, or Liquinox™. The use of any other detergent must be justified and documented in the field logbooks and inspection or investigative reports.

The standard cleaning solvent shall be laboratory-grade isopropanol. However, solvents may be substituted for a particular investigation if needed. Laboratory-grade acetone or methanol are both acceptable. However, it should be noted that if laboratory-grade acetone is used, the detection of acetone in samples collected with acetone rinsed equipment is suspect. Laboratory-grade methanol is much more hazardous to use than either laboratory-grade isopropanol or acetone, and its use is discouraged. The use of any solvent other than laboratory-grade isopropanol for equipment cleaning purposes must be justified and its use must be documented in field logbooks.

Deionized water is defined as tap water that has been treated by passing through a standard deionizing resin column. The deionized water should contain no heavy metals or other inorganic compounds (i.e., at or above analytical detection limits). Organic-free water is defined as tap water that has been treated with activated carbon and deionizing units.

Organic-free water should contain no pesticides, herbicides, extractable organic compounds, and less than detection limits of purgeable organic compounds. Deionized water as defined above will meet or exceed ASTM Type II specifications prior to use during this project.

During cleaning operations, the substitution of a higher grade water (i.e., deionized or organic-free water for tap water) is permitted and need not be noted as a variation of this document. However, the deionized and organic-free water utilized must be subjected to the specific quality control procedures as outlined below.

The brushes used to clean equipment as outlined in the various sections of this attachment shall not be of the wire-wrapped type.

#### **1.1.2 Marking and Segregation of Used Field Equipment**

Field or sampling equipment that needs to be repaired shall be identified with a tag. Field equipment needing cleaning or repairs shall not be stored with clean equipment, sample tubing, or sample containers. Field equipment, disposable sample containers, and sample tubing that are not used during the course of an investigation may not be replaced in storage without being recleaned unless it is the opinion of the field investigator that the materials have not become contaminated during the course of the field investigation.

#### **1.1.3 Decontamination of Equipment Used to Collect Samples of Toxic or Hazardous Waste**

Equipment that is used to collect samples of hazardous materials or toxic wastes or materials from hazardous waste sites, RCRA facilities, or in-process waste streams shall be decontaminated before it is returned from the field. At a minimum, this decontamination procedure shall consist of washing with laboratory detergent and rinsing with tap water. More stringent decontamination procedures may be required, depending on the waste sampled.

#### **1.1.4 Safety Procedures to be Utilized During Cleaning Operations**

The materials used to implement the cleaning procedures outlined in this attachment can be dangerous if improperly handled. Due caution must be exercised by all personnel and all applicable safety procedures shall be followed. At a minimum, the following precautions shall be taken in the field during these cleaning operations:

1. Safety glasses with splash shields or goggles, neoprene gloves, and a neoprene laboratory apron will be work during all cleaning operations.
2. All solvent rinsing operations will be conducted in the open (never in a closed room).
3. No eating, smoking, drinking, chewing, or any hand to mouth contact shall be permitted during cleaning operations.

#### **1.1.5 Storage of Field Equipment and Sample Containers**

All field equipment and sample containers shall be stored in a contaminant-free environment after being cleaned using the procedures outlined in this attachment.

### **2.2 SPECIFIC QUALITY CONTROL PROCEDURES FOR CLEANING OPERATIONS**

This section establishes guidelines for specific quality control procedures to monitor the effectiveness of the sampling equipment and sample container cleaning procedures outlined in this attachment. These procedures are specified in the QAPP.

### **2.3 CLEANING PROCEDURES FOR TEFLON™ OR GLASS FIELD SAMPLING EQUIPMENT USED FOR THE COLLECTION OF SAMPLES FOR ORGANIC**

**COMPOUNDS AND/OR METALS ANALYSES\***

1. Teflon™ or glass sampling equipment will be rinsed thoroughly with tap or deionized water in the field as soon as possible after use.
2. Equipment will be washed thoroughly with laboratory detergent and water using a brush to remove any particulate matter or surface film.
3. The equipment will be rinsed thoroughly with deionized/organic-free water.
4. Equipment will be rinsed twice with solvent (isopropanol).
5. Equipment will be rinsed thoroughly (three times) with deionized water.
6. Equipment will be allowed to air dry.
7. Equipment will be wrapped completely with aluminum foil to prevent contamination during storage and/or transport to the field.

- \* When this sampling equipment is used to collect samples that contain oil, grease or other hard to remove materials, it may be necessary to rinse the equipment several times with pesticide-grade acetone to remove the materials before proceeding with Step 2. In extreme cases, it may be necessary to steam clean the field equipment before proceeding with Step 2. If the field equipment cannot be cleaned utilizing these procedures, it should be discarded.

**2.4 CLEANING PROCEDURES FOR STAINLESS-STEEL OR METAL SAMPLING EQUIPMENT USED FOR THE COLLECTION OF SAMPLES FOR TRACE**

## **ORGANIC COMPOUNDS AND/OR METALS ANALYSES\***

1. Rinse the stainless-steel or metal sampling equipment thoroughly with tap water or deionized/organic-free in the field as soon as possible after use.
2. Wash equipment thoroughly with laboratory detergent and water using a brush to remove any particulate matter or surface film.
3. Rinse equipment thoroughly with tap water or deionized/organic-free water.
4. Rinse equipment twice with solvent (isopropanol) and allow to air dry for at least 24 hours.
5. Rinse equipment thoroughly with deionized/organic-free water.
6. Wrap equipment completely with aluminum foil to prevent contamination during storage and/or transport to the field.

\* When this sampling equipment is used to collect samples that contain oil, grease or other hard to remove materials, it may be necessary to rinse the equipment several times with pesticide grade acetone to remove the materials before proceeding with Step 2. In extreme cases, when equipment is painted, badly rusted, or coated with materials that are difficult to remove, it may be necessary to steam clean or wire brush equipment before proceeding with Step 2. Any stainless-steel sampling equipment that cannot be cleaned using these procedures should be discarded.

## **2.5 MISCELLANEOUS EQUIPMENT CLEANING PROCEDURES**



### **2.5.1 Well Sounders to Tapes Used to Measure Ground-Water Levels**

1. Wash with laboratory detergent and tap water.
2. Rinse with tap water.
3. Rinse with deionized water.
4. Equipment should be placed in a polyethylene bag or wrapped with polyethylene film to prevent contamination during storage or transit.

### **2.5.2 Other Sampling Equipment**

Miscellaneous sampling equipment shall be washed with laboratory detergent, rinsed with tap water, followed by a thorough deionized water rinse, and dried before being stored. This procedure is not used for any equipment utilized for the collection of samples for trace organic compounds or metals analyses.

### **2.5.3 Field Analytical Equipment and Other Field Instrumentation**

The exterior of sealed, water-tight equipment should be washed with a mild detergent (for example, liquid dishwashing detergent) and rinsed with tap water before storage. The interior of such equipment may be wiped with a damp cloth if necessary.

Other field instrumentation should be wiped with a clean, damp cloth; pH meter probes, conductivity probes, etc., should be rinsed with deionized water before storage.

#### **2.5.4 Ice Chests and Shipping Containers**

All ice chests and reusable containers will be washed with laboratory detergent (interior and exterior) and rinsed with tap water and air dried before storage. In the event that an ice chest becomes severely contaminated with concentrated waste or other toxic material, it shall be cleaned as thoroughly as possible, rendered unusable, and disposed of properly.

### **3.6 FIELD EQUIPMENT CLEANING PROCEDURES**

Sufficient clean equipment will be transported to the field, when possible, so that an entire study can be conducted without the need for field cleaning. However, this is not possible for some specialized items of field equipment such as power augers, well drilling rigs, soil coring rigs, and other large pieces of field equipment. In addition, during particularly large scale studies, it is not practical or possible to transport to the field all of the precleaned field equipment required. The following procedures are to be utilized when equipment must be cleaned in the field.

#### **3.6.1 Equipment Used for Routine Sample Collection Activities**

For routine operations involving classic parameter analyses, water-quality sampling equipment such as Kemmerers, buckets, DO dunkers, dredges, etc., may be cleaned with sample or deionized water between sampling locations. A brush may be used to remove deposits of material or sediment, if necessary. If deionized water is used, water samplers should be flushed with sample at the next sampling location before the sample is collected. It should be emphasized that these procedures cannot be used to clean equipment for the collection of samples for organic compounds or trace metals analyses.

Flow measuring equipment such as weirs, staff gages, velocity meters, and other stream gaging equipment may be cleaned with tap water after use between measuring locations, if necessary.

**3.6.2 Teflon™, Stainless-Steel, or Metal Equipment Used to Collect Samples for Organic Compounds and Trace Metals Analyses\***

1. Clean with tap water and laboratory detergent using a brush if necessary to remove particulate matter and surface films.
2. Rinse thoroughly with tap or deionized water.
3. Rinse twice with solvent (isopropanol).
4. Rinse thoroughly with deionized/organic-free or distilled water.
5. Rinse thoroughly with deionized/organic-free or distilled water and allow to air dry as long as possible.
6. Wrap with aluminum foil, if appropriate, to prevent contamination if equipment is going to be stored or transported.

\* Portable power augers or large soil boring or drill rigs should be cleaned as outlined in Section B.5.3 before boring or drilling operations.